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BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY.

Vol. XXXVIII **1906.** **No. 1**

THE DELTA OF THE RIO COLORADO.

BY

DANIEL TREMBLY MACDOUGAL.

WITH MAP BY GODFREY SYKES.

The Rio Colorado, the Nile of America, rises in the higher mountains of Wyoming and Colorado, cuts its way through cañons, mile deep for hundreds of miles, to the western edge of the great plateau, where it emerges to flow through the most arid desert in North America, finding its way into the head of the Gulf of California in a sub-tropical climate two thousand miles from its source. Here it spreads its delta with one edge to the westward against the huge sand-dunes or "algodones" of southern California, while the other stick of the fan lies far to the eastward along the margin of the Sonora mesa, where the jungle of the swamp meets the sparse vegetation of the arid gravel slopes and bluffs in striking contrast. Between the deserts to the west and to the east the radiating ribs of the delta fan, variously intertwined with subdivisions of the river, project against the Cucopa Mountains, which now rise clear-cut and cameo-like and now loom hazily against the southern horizon. The delta and the range beyond it, like many such "unknown" regions, have been visited in desultory fashion by the prospector, the hunter and trapper, and the nearest camps teem with stories of adventures, hazards, and disasters among its sloughs, tidal bores, volcanoes, sunken saline plains, and arid mountains.

The river runs at a low stage during three-fourths of the year, but in May the melting snows of the highlands swell the stream in an increasing volume until a height of a hundred feet above low-water mark is attained in the cañons during June and July, and the entire delta is practically submerged, or awash. This is the ordinary behaviour of the "great river," the only name by which it is known at present to the near-by Indian, and in accordance with immemorial custom he sows his crops in the mud of the receding waters in August and September. Once or twice in the lifetime of a man, or at intervals of fifteen to twenty years, a similar rise is caused by rains on the lower slopes in February and March resulting in serious disturbances to all life in the delta. The expedition of which the author was a member made its way through the delta on the crest of such a flood during the present year (1905). Previous visits to various portions of this interesting region had been made in company with Mr. Godfrey Sykes, who has also made several independent voyages through the estuary to the gulf. For two centuries occasional parties, attracted by the call of the "red gods" or by the lure of profit, have gone down the river to the sea, and perhaps not more than one in three of such adventurers have escaped hardship or disaster in some form.

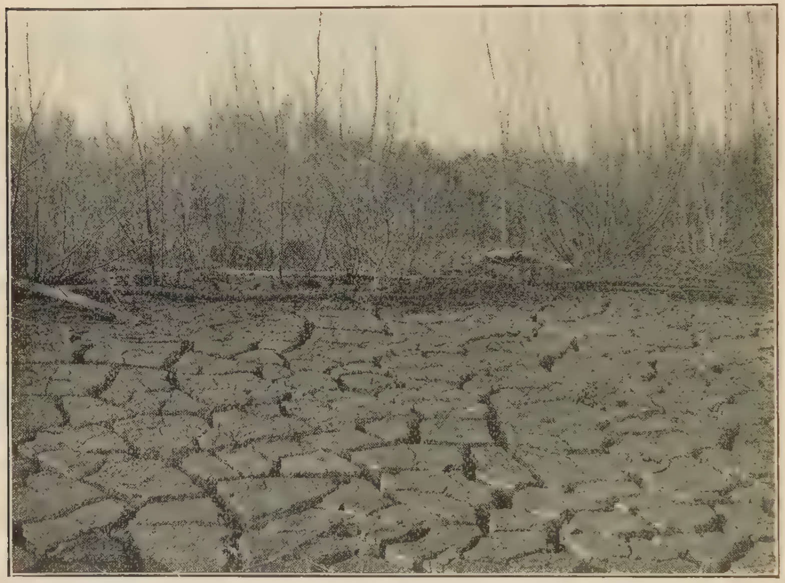


FIG. 1.—MUD FLATS SHOWING CONCHOIDAL FRACTURE WHEN DRY. MELONS AND CORN ARE PLANTED IN LARGE BOWL-SHAPED DEPRESSIONS DUG DOWN BELOW THE FRACTURES.

One of the most notable experiences of this character was that of Messrs. Skyes and MacLean in 1890, who, having started around the world in a small sloop from the head of the delta, had their boat and supplies burned on the eastern shore of Baja California, three hundred miles from civilization and a hundred miles from the nearest fresh water. Then followed a march across a veritable "Jornada del Muerto" not attempted successfully before or since by white or Indian, which was won out by an intimate knowledge of the ways of the desert and by sheer capacity for endurance. Half of the distance was made by reliance upon oysters gathered from the desolate shore, and the wáter from hot salty springs searched out by following the converging trails of coyotes, the same animal figuring on a bill of fare not too ornate; days of cruel plodding in the fierce heat of a tropical sun across a plain of yielding flaky saline deposit, then through all but impassable mud flats, and tule swamps of the delta to a hunter's camp found with a nicety that showed a marvellous blend of instinct with cool calculation.

The only parallel to this desert journey is to be found in the record of the Pattie party in 1828. Having been despoiled at the mouth of the Gila River by the Yuma Indians, they descended the river in dugout canoes rigged in pairs as catamarans, in search of settlements of whites. Encountering the tides and bores in the estuary, the return upstream was attempted only to be checked by a February flood, and the boats were abandoned. Under guidance of the Indians, a march was made across the desert to the snow-covered mountains to the southwestward, during two days of which the party was entirely without water. Crossing a plain ankle deep in sand, the exhausted travellers with difficulty threaded their way through the thickets of cacti to a small stream issuing from a cañon at the base of the mountains, and from here made their way to the now extinct mission of Santa Catalina and to other adventures. Neither has this journey yet been duplicated by white men.

The main channel of the river was mapped by Derby and Heintzelman in 1852, and by Ives in 1857, but its course as traced by these earlier voyagers coincides as little with the stream of the present day as with the tracings made three centuries ago by Spanish priests and soldiers. During all this period, however, the river has been cutting away at the edge of the Sonora desert at two or three points. It makes a long reach to the westward directly away from the mesa at Yuma, then a slight curve to the northward, after which it leads away to the south, passing into many involved convolutions, one of which strikes the mesa at a point marked "Sandy Bluff" but a few miles below the international boundary. A short distance down stream (eight or ten miles) the current swings back against the gravel bluffs, and then leaves the mesa to touch it again only at the gravel or sand bluffs near the head of tidal action usually known as the "Colony Mesa." The cutting action of the current is rapid and continuous at these exposures. Small rivulets of sand and gravel trickle continuously down the steep slopes of the cliffs, and occasionally large masses are detached and fall into the water with no little commotion.

At these places may be found within a compass of a hundred feet the most vivid contrasts of rank swamp vegetation and water-loving plants having broad leaves and delicate tissues with the toughened, spinose, and hairy, xerophytic forms of the desert. The presence of the moist area of the delta has but little effect upon the climate of contiguous arid regions, although a popular supposition to the contrary promises fairly to be immortal. The relative humidity here is often as low as seventeen per cent. within fifty feet of the margin of the water. During the recent visit to this region however, clouds of mosquitoes from the delta had been blown for many miles across the sandy plains, and these pestiferous swarms among the creosote and sage bushes gave a deceptive but unalluring appearance of alteration of climatic factors.

The above conditions are well illustrated by the following data, obtained in 1904. For purposes of comparison, observations were made on the alluvial plain among the leafless willows and poplars during the dry season, and the results were:—

January 28.	4:30 P.M.	60° F.	17% rel. hum.
January 28.	6:30 P.M.	55° F.	15% rel. hum.
January 28.	8:00 P.M.	51° F.	18% rel. hum.
January 29.	12:45 A.M.	32° F.	41% rel. hum.
January 29.	1:20 A.M.	30° F.	50% rel. hum.
January 29.	6:00 A.M.	29° F.	66% rel. hum.
January 29.	6:25 A.M.	27° F.	70% rel. hum.
January 29.	7:00 A.M.	38° F.	60% rel. hum.
January 29.	7:40 (Sun on instrument)		36% rel. hum.

Observations were also made on the "Upper Mesa" or "Line Mesa" at a distance of less than a hundred and fifty feet from the margin of the bank, among typical desert shrubs which were scattered over the gravel plain in characteristic fashion. The following data were obtained:—

January 30.	4:40 P.M.	70° F.	19% rel. hum.
January 30.	4:50 P.M.	68° F.	16% rel. hum.
January 30.	7:00 P.M.	54° F.	15% rel. hum.
January 30.	8:30 P.M.	48° F.	27% rel. hum.
January 31.	7:30 A.M.	45° F.	29% rel. hum.
January 31.	6:30 A.M.	44° F.	30% rel. hum.

The high level of the March flood, being fairly uniform, is very useful in determining certain topographical features of the delta and its relation to the adjacent territory. Thus an old trapper who had frequented the river twenty-five years ago had left behind him the tradition that a channel left the main river above tidewater, and seventy-five miles from the mouth, and flowed southeasterly into the head of the Gulf of California—an assertion which had never been confirmed. The only known depression suitable for such a flood-waterway would be offered by the Santa Clara River, a shallow stream which heads back from the Gulf into the Sonora desert some distance from the river and sends a feeble current of salty water through its shallow reaches to the sea. An investigation of this feature from a camp near the head of the Santa Clara showed that the reddish waters of the Colorado left the main channel just above the "Colony Mesa" and flowed in great volume through a depression into the Santa Clara, forming a navigable stream which might easily, with a shift of the cutting action of the current, become the main way of the Colorado.

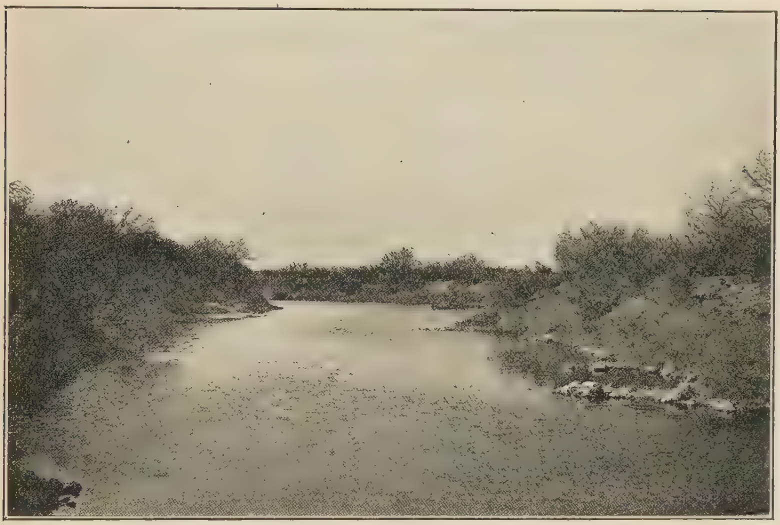


FIG. 2.—THE SANTA CLARA RIVER, ONE OF THE HIGH-WATER OUTLETS OF THE COLORADO RIVER, NEAR COLONIA LERDO.

An immense amount of sediment, which has been estimated at sixty million tons yearly, is carried down into the delta and deposited on the bars and banks of the various channels, giving rise to the assertion that appreciable construction of solid land has occurred within the observation of persons now living. This view is supported by the fact that the willows and poplars, which do not inhabit the lowest land moistened with brackish water, have advanced about ten miles farther south within the memory of certain Indians, and also by the formation of Hilda Island in the lower reach of the river, which is recorded on the accompanying map for the first time, and which was first noted by Mr. Godfrey Sykes while descending the river in the sloop Hilda in 1890.

The sparse records of the last century show that islands have appeared and disappeared in the lower reaches of the river in a very capricious fashion. The funnel-shaped head of the Gulf of California shoals abruptly in the mouth of the river, and flood-tides reach a height of forty-one feet above low water. These conditions lead to the formation of a bore which sweeps upstream at the close of the ebb in a comber four to six feet in height, striking the exposed shores with great violence and starting new points of erosion and shoal deposit. Within the region affected by the tides, the tules and tall

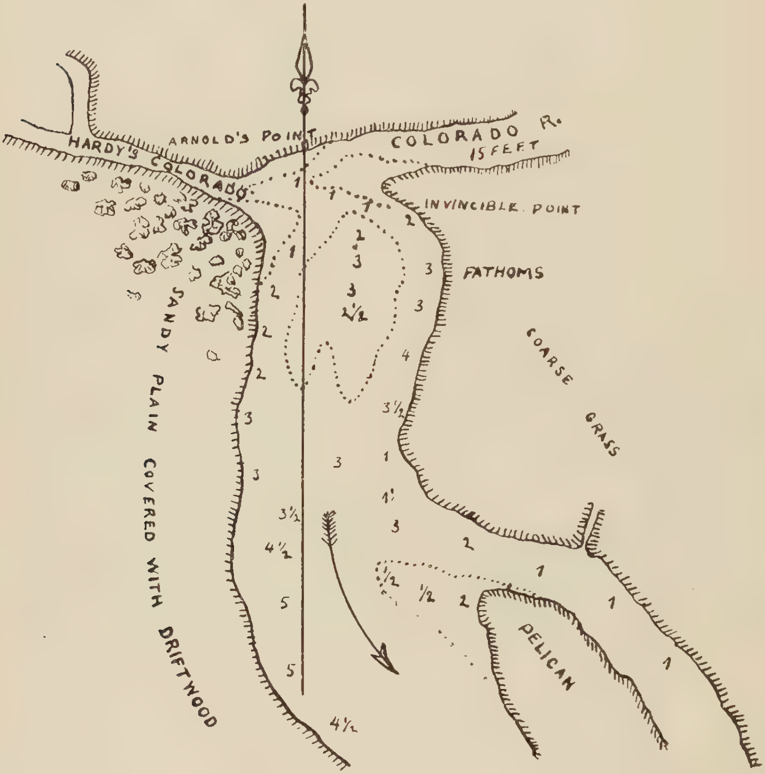
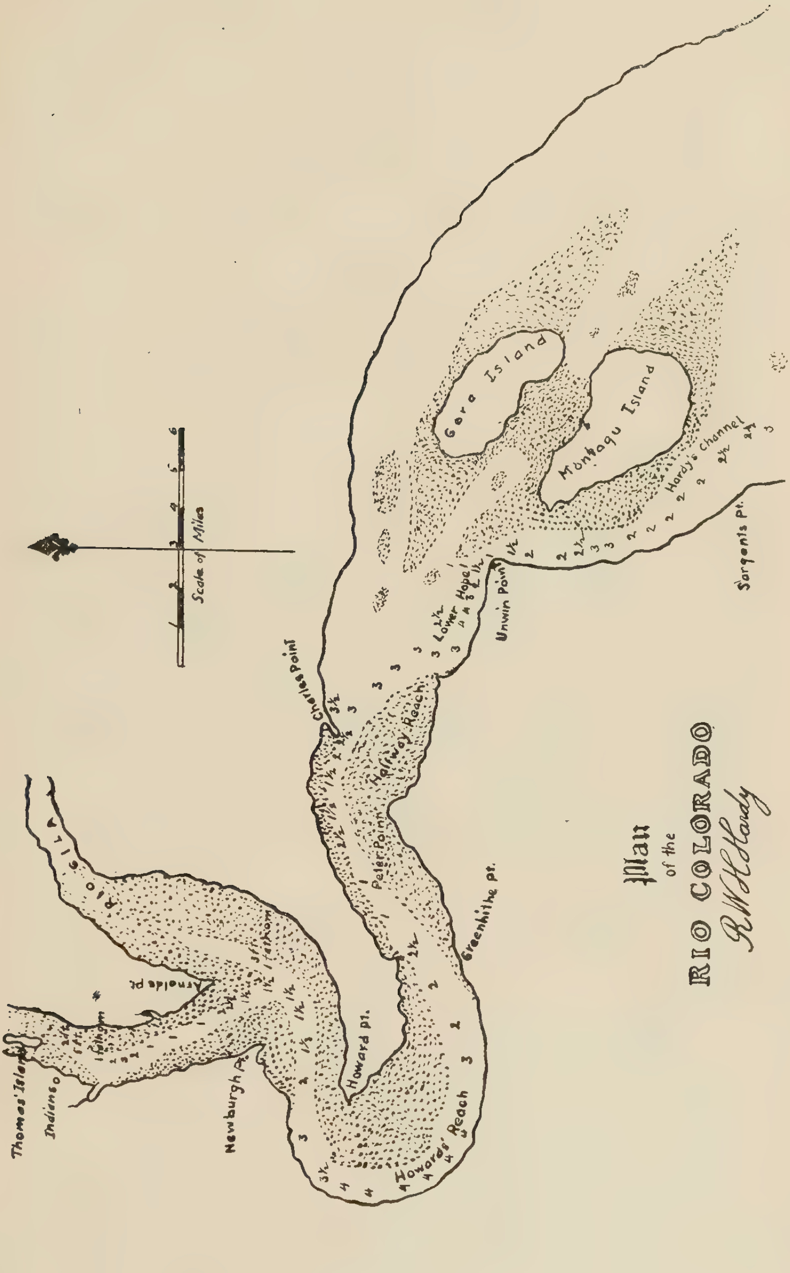


FIG. 3.—SKETCH OF THE MOUTH OF THE COLORADO RIVER MADE BY LIEUTENANT DERBY IN 1850, DIFFERING SLIGHTLY FROM THE GENERAL MAP OF THE WHOLE RIVER MADE BY HIM AND MAJOR HEINTZELMAN.


Map
of the
RIO COLORADO
R W H Hardy
Scale of Miles
Thomas' Island
Indians
Newburgh Pt.
Arnolds Pt.
Rio Gila
1 fathom
Howard Pt.
Howards' Reach
Greenhithe pt.
Peter Point
Halfway Reach
Charles Point
Lower Hope
Unwin Point
Gore Island
Montagu Island
Hardy's Channel
Sargents Pt.

vegetation along the shores may be seen to be leaning upstream as a result of the smashing effect of the uprushing bore, which is a serious menace to all but the largest craft which seek to navigate the river.

In 1826 Lieut. R. W. H. Hardy, "Commissioner of the General Pearl and Coral Fisheries of London," made up the lower reaches of the river in a small vessel to a point where a wide stream was seen coming in from the northwestward, which he mistook for the Colorado. This stream is now known as Hardy's Colorado, and is the channel which binds together the ribs of the delta fan, gathering the water which leaves the Colorado in the Pescadero, Paredones, and other unnamed channels, and emptying it back into the main river before it reaches the Gulf. Not all of the water, however, which leaves the main river returns to it, or finds a way to the sea.

The Hardy has its origin in a shallow body of water known as Volcano Lake, which lies in the western part of the delta on the crest of a gentle swell, and which receives the water of the Paredones running out of the Colorado. To the northwestward the drainage from this lake is toward the Salton basin, which is from fifty to a hundred and twenty-five miles in diameter, and which has its salt-covered floor more than three hundred feet below sea-level. Water which flows out of Volcano Lake through New River to the westward, as well as other channels coming directly or indirectly from the Colorado, trickles over the edge of the giant bowl and rushes down its steep slopes, forming a lake in the bottom of the basin. Such floods, re-forming Salton Lake, occurred in 1828, 1849, 1861-2, 1891, 1905, and perhaps in other years in which records are not available. This last flood poured enough water into the basin to form a lake with an area of about six hundred square miles, which in November, 1905, was reported to be increasing in depth and extent.

According to Indian traditions, this great basin has been filled to the brim in times past, abounded in fish, and people lived along its margin in many villages. "Poco a Poco" the floods receded, however, until a desert remained. The floods within historic times have in some instances poured vast quantities of water into the basin; but this generally evaporates in a few months in the blazing heat of the sun, which gives temperatures of about one hundred and twenty degrees Fahrenheit in the shade, and which has an evaporating capacity of twelve to twenty feet of water yearly.

The intake of additional quantities of water into the sunken basin is now facilitated by a huge canal led off from the Alamo Slough and the Colorado River for the purpose of irrigating lands lying around the upper rim of the bowl, and the reappearance of the ancient sea as a permanent feature is by no means among the impossibilities.

Another basin below the sea-level connected with the delta is to be found on the farther side of the Cucopa Mountains, which bound the delta on the southwest. During floods the waters bathe the entire eastern foot of the mountains, and great volumes find a way around the southern end of the range to this basin, filling the depression in two places known as the Laguna Maquata and Coyote Laguna. These are also soon dried up after the supply of water ceases.

The topographical features described above combine to make the Cucopa Mountains, which are to be reckoned as among the most arid on the continent, a peninsular ridge at high water connected with dry land by a narrow strip a few feet only above sea-level, and extending northwestward across the international boundary.

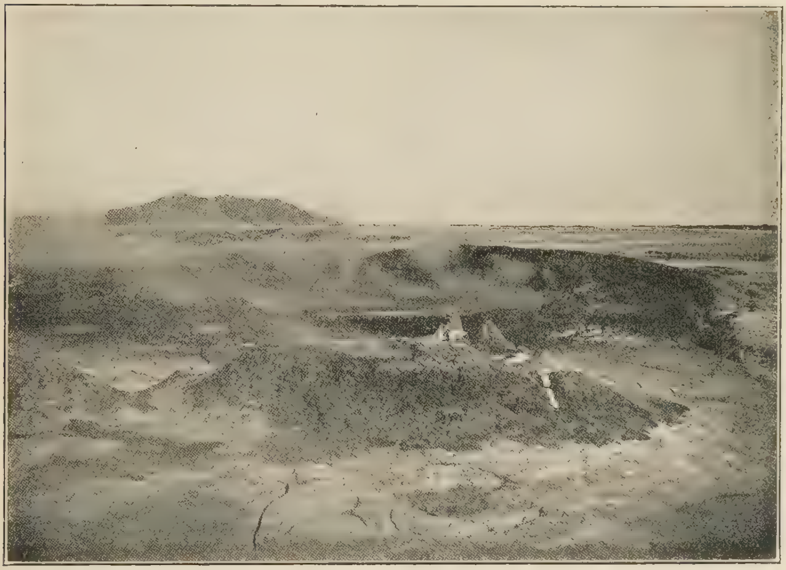


FIG. 5.—ACTIVE MUD-VOLCANOES NEAR VOLCANO LAKE. CERRO PRIETO, THE LARGEST OF THE GROUP SEEN IN THE DISTANCE, IS NOW QUIESCENT.

Not unexpectedly to the naturalist, this range affords many endemic species of plants and animals, and those which range beyond its confines bear a more intimate relation with the forms inhabiting the mainland of Mexico and Arizona than to the remainder of peninsular California.

Hot springs and other manifestations of volcanic energy are to be found all along the geological vault on the eastern side of the peninsula of Baja California, but the most pronouncd feature of this character is to be found well out in the delta near Volcano Lake. Here on a saline plain a few miles in extent innumerable small mud cones, solfataras, and boiling pools of mud and water emit steam, smoke, and sulphurous gases, accompanied by a dull rumbling sound. According to the traditions of the Cucopa Indians, formerly a member of the tribe accused of sorcery or other serious crime was sent back to his evil master by the simple process of dropping him into a pool of boiling mud—an obvious entrance to his abode below. Flood-water covers a number of the small volcanoes, and then quite an extended area of the lake is agitated by the eruptions from below.

The largest of the volcanoes, known as the "Cerro Prieto," stands on the margin of the gravel slopes leading down from the main range of the Cucopa Mountains and rises as an irregular black mountain to a height of 750 feet, with several minor craters on its sides. The main crater is regular in form, and shows indications of activity at no remote time, although the bottom of the bowl now bears the characteristic vegetation of the desert, but including some species not now known elsewhere. In connection with the volcanoes are some boiling springs, which come to the surface a few feet above the level of the flood-water which flows from Volcano Lake into the Hardy. Immersed in the steaming water is a blue-green alga, which has been hitherto reported only from similar hot springs in Algeria, offering a problem in distribution the solution of which cannot even be conjectured.

The portion of the delta included in the Salton basin, which lies below sea level, and which is mostly within the State of California, is a true desert by means of its aridity and the saline character of the soil; consequently the plants and animals are referable to the Colorado desert, of which it in reality forms a part. The area actually irrigated by the river in normal low water and flood, however, is surrounded on all sides by desert and salt water, and is in reality a biological island. As such it offers an interesting comparison with the Cucopa Mountains, which limit it on the southwest, and which also constitute a sharply-defined life-area.

The quantity of food furnished by the swampy jungles is sufficient to support a vast amount of native animal life, and furnishes inviting feeding grounds for migrating birds. The countless millions of young willow and poplar shoots supply food for the beaver, which bids well to hold out long in the impassable bayous and swamps against its trapper foe.

The soil, climate, moisture, and temperature of the entire delta are fairly uniform, and also differ but little in elevation and exposure—a condition which tends to promote the multiplication of the number of individuals of a few species of plants, and these species are also able to maintain themselves in pure culture of some extent. An analysis of the vegetation of the delta confirms this view. Canes (*Phragmites*), cattails (*Typha*), willows (*Salix*), poplars (*Populus*) arrow-weed (*Pluchea sericea*), quelite (*Amaranthus Palmeri*); wild hemp (*Sesbania*), each occupy extensive areas, to the almost total exclusion of other seed-plants, although there are many places in which several of these will be found contending for the mastery. In all such areas of unstable equilibrium some change of the drainage, or of the action of the river, will be found as a disturbing cause.

Nearer the Gulf are found great sloughs, in which are extensive fields of the "wild rice" (*Uniola Palmeri*), while the land subject to the action of the overflow of the tides supports a carpet of salt-grass (*Distichlis*) and *Cressa.* Throughout the entire delta the mesquite (*Prosopis velutinea*) and the screwbean (*Prosopis pubescens*) dot the landscape, and furnish examples of one of the few components of the vegetation, the individuals of which grow singly and apart. The salt bush (*Atriplex*) also grows singly in great globular bunches overtopping the head of a man, on the lower stretches of saline soil.

In the enumeration of the following plants which have been found in various parts of the delta occasion is also taken to add notes as to known uses made of them by the Cucopa Indians:

Achronychia Cooperi A. Gray.

Saline soil near Volcano Lake.

Amaranthus Palmeri. Quelite.

Growing in open ground flooded at highest water. The young plants furnish forage for grazing animals, and are also eaten by the Indians. The mature plant reaches a height of 10 ft., and develops a crop of small shiny seeds, which are collected and stored for use as food.

Ammania latifolia L.

Along the Colorado on exposed banks.

Atriplex fasciculata S. Wats.

In saline soil near Volcano Lake.

Cressa Truxillensis H.B. K.

Mud-flats, forming extensive carpets with salt-grass in the southern part of the delta, in which the soil is slightly saline.

Cucurbita palmata.

Low ground throughout the delta.

Diplachne imbricata (Thurb).

Along the banks of the river and streamways.

Distichlis spicata (L.) Greene. Salt grass.

Forming carpet with Cressa in southern part of the delta, in which the soil is saline.

Echinochloa Crus-galli (L.).

Low ground near bayous and wet places. The seeds of this grass are probably to be included among those used for food.

Eclipta alba (L.). Hook.

Along the banks of the Rio Colorado near the margin of the stream.

Lippia cuneifolia (Torr.). Skud.

Exposed banks and bare places near the river.

Phragmites Phragmites. Cane, Carrizo, Tule.

Along the margins of streams, forming dense brakes. Used for making huts, flutes, and also in the construction of various articles.

Pluchea sericea (Nutt.). Coville. Arrow-weed.

In dense copses, forming pure cultures on banks above ordinary flood-level. Used by Cucopa Indians to form the shafts of arrows, to make the wattling and roofing of huts, for weaving coarse baskets, and granaries, etc.

Populus.

The young shoots are used, with willows, for wattling and portions of trunks for construction of huts.

Prosopis pubescens. Tornillo. Screw-bean.

Wood used in the same manner as the mesquite.

Prosopis velutinea. Mesquite.

The wood of the trunks is used for construction of all kinds, for making fires, and for tipping the points of arrows. The beans are collected and used for food.

Rumex sp. Dock.

Moist soil in open spaces.

Salix. Willow.

Two species are abundant throughout the delta, and these furnish material for use in huts, for the making of small hunting bows, and for miscellaneous purposes.

Scirpus fluviatilis A. Gray.

Mud flats throughout the delta.

Scirpus Californicus (C. A. Meyer). Britton.

Margins of streams.

Sesbania macrocarpa. Wild hemp. Wild flax.

Grows in open portions of the delta below flood-level, and sometimes reaches a height of 15 ft. The stems furnish a fibre which is used by the Indians for bow-strings and for other purposes as cords. Some attempts have been made to introduce this fibre into commerce.

Sesuvium sessile.

Along the shores of streams in the lower portion of the delta, in which the soil is moistened by water slightly saline or brackish.

Allenrolfia occidentalis.

Along the Santa Clara slough and other areas, in which the soil is saline.

Typha latifolia. Cat-tail tule.

Growing in level areas below flood-level and multiplying rapidly by means of offsets and forming pure cultures of great area. The underground stems, which are tender and succulent, are eaten by the wild hogs, while the sword-shaped leaves are used to pack the interstices of huts, and especially the small sweat-houses which are erected at the margins of lagoons. The great smokes which are seen almost constantly in the delta are mainly made by burning brakes of cat-tails for hunting purposes.

Uniola Palmeri. Wild rice.

Grows in the sloughs and wet places in the southern part of the delta, and the seeds are used as food by the Cucopa Indians.

At one time a herd of domestic hogs were turned loose in the tule swamps of the delta, and their progeny have reverted in so many features as to be as savage and untamable as their ancestors of a thousand years ago. Here, preying upon the hog and deer, is also to be found a "mountain lion," of a variety not found elsewhere, and even the widely-ranging coyote constitutes a species peculiar to the region, and quite at home in the mud of the swamps and bayous.

Surpassing in interest all other features of the delta is the Cucopa Indian, who inhabits it, and who is the heir and successor of many vanished tribes. First mentioned in the records of the expedition of Coronado in 1540 as seen to habitually carry fire-brands, which these old explorers naïvely thought was done for the purpose of keeping the hands warm, they were designated as the Tizon (firebrand) Indians, and the river received the same name. As a matter of fact, smouldering fagots were carried for the simple purpose of preserving fire and for its convenient use in burning the tules and canes to drive out animals hunted for food. At the beginning of the seventeenth century, Oñate descended the river to the mouth, and estimated that twenty thousand Indians were living in the eastern part of the delta alone, including various tribes, such as the Hatchedumas and Tlalliguamayas; but these, as well as the Quiquimas and Cutganes of the western part of the delta, have long since vanished from the region. Even as late as 1826 Hardy saw many thousands of Cucopas around the mouth of the Hardy; yet to-day the total population of the delta and the adjacent habitable part of the desert does not exceed three hundred. The only relics of the vanished hordes consist in hundreds of square miles of sandy plains strewn with fragments of coarse red pottery, and a prehistoric trail along the eastern foot of the Cucopa Mounains at the southwestern edge of the delta. For many miles the waters of the Hardy actually bathe the base of the rocky declivities, and along here the highway, as old as the race itself perhaps, is crowded into a narrow path. For untold cycles, until within a century, this trail must have been one of the most travelled of the southwest, since it led from the interior deserts and mountains to the wild rice fields and fishing grounds at the head of the Gulf, and was doubtless an inter-tribal highway of scarcely less importance than that along the Gila.

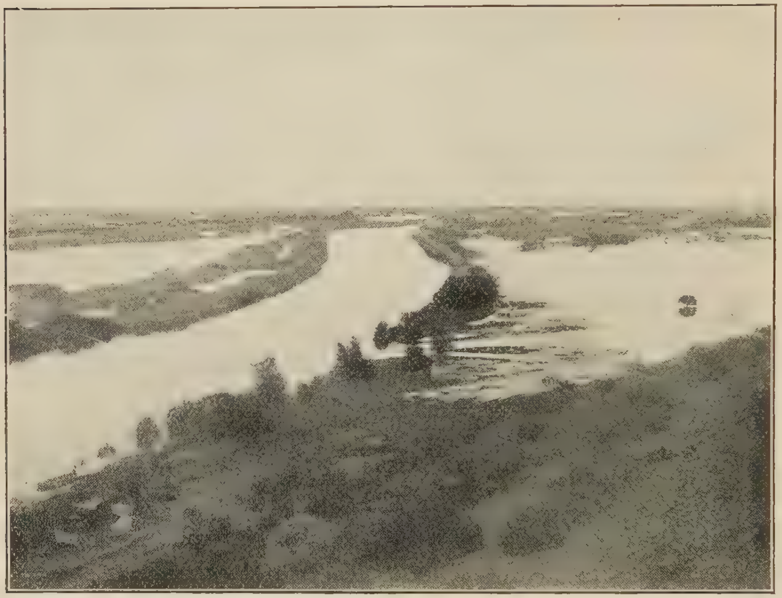


FIG. 6.—HARDY RIVER AT BASE OF CUCOPA MOUNTAINS. THE CHANNEL IS LINED WITH WILLOWS, CATTAILS, MESQUITE AND TULES. BETWEEN THE CAMP AND THE BASE OF THE SLOPE IS THE ANCIENT INDIAN TRAIL.

Within recent times the Cucopa Indians have been bested in a war with the Yumas at the head of the delta, but neither the losses suffered in this defeat nor traditions of other wars may account for this diminishing population. In the losing struggle carried on by this dwindling remnant, the deleterious effects of civilization have played but small part. Similar decreases of population in fertile river deltas are not unknown in other parts of the world. The native of the Colorado delta is a sturdy, well-built, peace-loving farmer of industrious habits by the standards prevailing in the land of the mañana, but he is notably lacking in handicraft or manual expertness of any kind. Living in a land cut and intersected in all directions by streams, he is neither a skilful boat-builder nor an expert canoeist, while the unaccountable tides and bores of the Gulf fill him with dread. The river teems with fish easily caught at times, and he lacks this food entirely when fishing becomes difficult. The tules swarm with game of many kinds, but the Cucopa is not a shrewd hunter. By the custom of his tribe all of his most necessary articles of personal use are burned or destroyed upon the death of a near relative, in consequence of which he does not weave textiles, make pottery, or build houses with enthusiasm or enduring effect, and is almost devoid of means of artistic expression of the symbols of his history or beliefs, and his diminishing numbers seem but an obvious illustration of the non-survival of the unfit.

The struggle for existence in the jungles of the warmer portions of the earth is one in which the human animal is often unsuccessful. The chief force against which he must contend is the rampant growth of vegetation, which impedes his agricultural efforts, and which makes all but impossible the breeding and preservation of domestic animals. Then in the protection of the jungle, wild animal life, from the most minute to the largest, multiplies with such rapidity as to constitute a hindrance to profitable effort, if not a formidable menace to health and bodily safety. Add to these the yearly summer inundation of the lands of the delta and the occasional flood of the winter, and conditions are created which may be met successfully only by the highly-organized methods of civilized society, and not by the intermittent, badly-directed individual effort of the aboriginal, who at best but holds his own in such a contest. With every pulsation of the summer heat the jungle closes a hardly measurable but positive accretion about his fields; with the loss of a working member of the family circle he handicaps himself to the limit of all he has previously gained, and when the creeping flood silently covers the land and drives him unprovided to the desert he must repeat the history of his race to regain his previous advantages.

With the initiation of the Yuma project for irrigation of the areas contiguous to the river in and around the head of the delta, a movement has begun which will make the alluvial lands a home of many thousands. The work of converting the delta to the uses of civilization will be hindered by the fact that some of the main drainage channels cross and then recross an international boundary; but doubtless in a comparatively brief period the agricultural aspect of the entire area will approach that of the Nile, which has supported a teeming population for centuries.

TOPOGRAPHIC SURVEYS OF THE UNITED STATES IN 1905.

During the season of 1905 topographic mapping was continued with vigour in the eastern portion of the United States. In Maine the U. S. Geological Survey, in co-operation with the State Survey, completed the mapping of an area of about 220 square miles on the upper Kennebec River, in Somerset County. The scale of this work was one mile to one inch, and the relief is shown in contours of twenty-foot interval. This region is just below Moosehead Lake, and has been lumbered over extensively in past years. It has been overgrown in recent years with second growth, is practically impenetrable by roads or paths, and abounds in game, including large numbers of grouse and deer and some moose. The map of this region will be of great value to lumbermen and to engineers, some of whom are now engaged in extending the Somerset County Railroad north from Bingham. Incidentally, the Hydrographic Branch of the Geological Survey made detailed surveys of Moosehead Lake and of the Moose River and the lakes along it, including Brasson and Long Pond. These latter investigations are made to determine the storage capacity of this region for supplementing the flow of the river for the production of water-power.

Very little progress was made in the topographic mapping of New York as compared with previous years, because of the failure of the Governor to approve the bill which had passed the State Legislature for continuing the topographic survey of the State in co-operation with the United States Geological Survey. Accordingly, after plans had been perfected for pushing the survey of the State to completion, the parties had to be withdrawn, and only a little work was done to close up some partially-mapped areas. This included about 900 square miles mapped near Loon

Lake in the Adirondacks, about Port Leyden and near Sangerfield and Winfield in Madison and Herkimer Counties.

In Pennsylvania, in co-operation with the State Survey Commission, an area of about 1,200 square miles was mapped on a scale of one mile to one inch and in twenty-foot contours. This will be represented upon six atlas sheets—one north of New Castle in Lawrence County, one west of Washington, one each northwest and southwest of Harrisburg, one south of Reading, and one near Clarion. The progress made in mapping Pennsylvania, while satisfactory, was not as rapid as it should be for the completion of the survey of such an important State. There remain yet practically unsurveyed thousands of square miles in the central and northwestern parts of the State, which are its roughest portions.

In Maryland an area of about 300 square miles was mapped in detail on the scale of one mile to one inch and with twenty-foot contours. This work was done in co-operation with the State Geologist. This was chiefly re-surveys of old reconnaissance maps made south and west of Baltimore in the neighbourhood of Relay and Laurel. The survey of the entire Eastern Shore of Maryland has been completed, and there remains only a small area of the State, chiefly in Montgomery, Frederick, and Washington Counties, yet to be mapped.

In West Virginia better progress was made than usual in topographic surveying, an area of about 1,100 square miles having been completely mapped on a scale of one mile to one inch and with twenty-foot contours. At the request of the State Geologist, in co-operation with whom this work was carried on, this was in the neighbourhood of Kingwood, Thornton, Belington, and Parsons, in the northeastern corner of the State, and near Arnoldsburg, Spencer, and Ripley, in the western part near the Ohio River. All of these sheets have great value in connection with the development of railways which are being rapidly built in this region and of the wonderful gas and coal resources.

In Virginia an area of 220 square miles was mapped about Yorktown and Jamestown because of the interest in the approaching Jamestown Exposition. Topographic mapping was commenced also, on a scale of one mile to one inch, over the region about Natural Bridge and Buchanan.

In North Carolina, in co-operation with the State Agricultural Department, three sheets of 225 square miles each were completely mapped—one a little west of Elizabeth, one in Sampson County south of Smithfield, and one about Charlotte. In South

Carolina about 600 square miles were mapped, a portion of the area being northwest of Chester near Yorkville and the remainder immediately northwest of Spartanburg. These various areas were selected because of the interest in the neighbourhood of Charlotte and in the eastern part of North Carolina in the movement for the improvement of roads, and in South Carolina because of the valuable mineral resources being developed in that area. In western North Carolina an area of 1,000 square miles, covered by the old reconnaissance Cowee sheet, was re-surveyed in detail, and will be of service for the further development of the valuable deposits of precious earths, including zircon and monozite and the gem hiddenite, for which this region is justly famed.

In Georgia a small area was surveyed in detail on the scale of 2,000 feet to one inch about Dahlonega, for the more intimate study of the gold resources of that region, which is the best gold-producing area in the eastern part of the United States. In western Georgia an area of 1,300 square miles was surveyed on a scale of two miles to one inch, with contours of fifty-foot intervals, immediately north of Columbus and extending to the Chattahoochee River and the Alabama State line. Here also some important mineral developments are in progress.

In Alabama, and with a view to more detailed study of the iron deposits about Birmingham, detailed surveys were completed of an area of about 400 square miles about Bessemer and Birmingham, the scale of the work being about one mile to one inch and with contours of twenty-foot interval. In addition a large-scale detailed map of the urban district including the cities of Bessemer and Birmingham was completed on the scale of 2,000 feet to one inch. In Mississippi and Alabama surveying is now in progress on the scale of one mile to one inch. In Mississippi an area of about 500 square miles will be completed about Jackson, and in Louisiana an area of equal amount about Baton Rouge.

In Kentucky, in co-operation with the State, an area of about 450 square miles was surveyed on the scale of one mile to one inch about Frankfort and Versailles and near Louisville. In addition a large detailed city map was made of the urban district about Louisville, including New Albany and Jeffersonville, Indiana, on the scale of 2,000 feet to one inch.

Unusually good progress was made in topographic mapping in Ohio, in co-operation with the State. An area of 3,700 square miles was completely mapped. This covers portions of eighteen atlas sheets distributed throughout various parts of the State. The larger groups are included in five sheets mapped in the northeastern corner of the State, three southwest of Cleveland and New Manchester, two in the southeastern corner along the Ohio River, and several in the western portion of the State near the Indiana border. In addition a large amount of primary control and spirit-levels was extended to prepare for the future mapping of the unsurveyed areas.

In Illinois six sheets of about 220 square miles each were mapped in co-operation with the newly-created State Geological Survey. All are on the scale of one mile to one inch. Two about Champaign and Urbana, with contour intervals of ten feet; one near Springfield, one east of St. Louis, and two near Eldorado, in the southeastern corner of the State, were mapped with twenty-foot contours. The latter sheets cover areas of much interest to the geologists in connection with the study of the valuable coal deposits of those portions of Illinois.

In Michigan a fair start was made in topographic mapping in co-operation with the State Geological Survey. The Marquette sheet was completed in much detail, and will be of value in the study of the celebrated Marquette Iron Range. North of Detroit preliminary surveys were made over quite an area between Pontiac and Howell.

In Wisconsin topographic mapping was completed over an area of 220 square miles east of Madison, and preliminary surveys were completed over a similar area immediately east of La Crosse, in Monroe County.

In Minnesota an area of 220 square miles was mapped on the scale of one mile to the inch, including Lake Minnetonka, an important summer resort region immediately west of Minneapolis.

In North Dakota an area of 1,000 square miles was mapped on the scale of two miles to the inch and with contours of fifty-foot interval in the neighbourhood of Bismarck. The resulting maps are of importance in connection with the development of the extensive lignite deposits found along the Missouri River in this region and in connection with the reclamation of valuable lands along the Missouri bottoms.

In Iowa an area of about 225 square miles was mapped on the scale of one mile to one inch about Des Moines, and will be used by the State and Federal geologists in studying the coal deposits in that region.

In Nebraska an equal area was mapped on the same scale about Nebraska City, on the Mississippi River south of Omaha.

In Missouri an area of 1,000 square miles was mapped on the scale of two miles to one inch immediately south of Springfield and between Ozark and the Arkansas State line. In the northeastern portion of the State between Macon and Shelbyville preliminary mapping on the mile scale was in progress with a view to the completion next year of the survey of an area of about 1,000 square miles.

In the western or arid portion of the United States the topographic mapping was pushed vigorously in nearly every State. In the course of this work some interesting local facts were developed, as the depth of the Salton Sink in southern California and the conditions arising from the filling of the Sink from the break made in the banks of the Colorado River. The survey of Death Valley, Nevada, brought up some new information concerning the depth of this valley below the sea-level, as well as some interesting facts regarding the Amargosa Valley and the Ralston Desert. The region about Mt. Whitney was mapped and the exact height of that mountain determined by spirit-level. New and large-scale surveys were made of the Yellowstone National Park and of the Grand Cañon, Colorado, near the railroad to Bright Angel, both of which result in some of the most remarkable and interesting topographic maps ever produced. An interesting phenomenon developed was the movement of benchmarks, some nearly as much as one foot in elevation, in the southern portion of the San Joaquin Valley, California, probably by earthquakes.

In the extreme northwestern portion of the State of Washington, along the Canadian boundary and Puget Sound, an area of 250 square miles was surveyed in Whatcom County. The scale of this mapping was one mile to the inch, and it covers a region which is found to be quite arid, and is, in fact, the most westerly as well as the most northerly arid region in the United States, exclusive of Alaska. Primary triangulation for the control of future mapping in this region was extended from the Sound eastward, near the Canadian boundary, across the Nooksak River to Mt. Baker. This peak, the elevation of which is 10,827 feet, is one of the most picturesque and beautiful volcanic cones in North America. Its aspect is particularly attractive as seen from the Sound between Port Angeles and Victoria. In eastern Washington an area of 250 square miles was surveyed on the scale of two miles to one inch, near Colfax, which is one of the most important wheat and grain regions in the northwest.

In Malheur County, Oregon, east of the celebrated Modoc lava-bed country, an area of 700 square miles was mapped on a scale of two miles to one inch, including the rich Owyhee and Malheur Rivers. In southwestern Oregon an area of about 900 square miles was mapped on the scale of two miles to one inch in the neighbourhood of Grant's Pass, which is on the short line between California and Oregon and a little north of Mt. Shasta.

In California primary triangulation and levels were extended over portions of Trinity and Siskiyou Counties for the control of future topographic mapping. This includes the region in which Mt. Shasta occurs, and covers the head waters of the Trinity, Salmon, and Klamath Rivers. Topographic mapping on the large scale of two inches to one mile was extended over about 500 square miles of northern Sacramento Valley, in Colusa and Yolo Counties. This work will serve as a basis upon which to study projects for the reclamation of rich agricultural lands of this region. In San Joaquin and Alameda Counties, in the lower part of San Joaquin Valley, an area of about 500 square miles was mapped on the scale of one mile to one inch. This region is immediately southeast of San Francisco, and is highly settled and cultivated.

The valley of Yosemite Park has been mapped on the specially large scale of 2,000 feet to one inch, with contours of fifty-foot interval. This map covers about 40 square miles, and develops in a most remarkable manner the topography of this extremely interesting region, showing up as it does the details of the almost perpendicular rock walls which surround the valley. Near this region and east of the Big Trees Grove, in Tuolumne County, an area of 250 square miles was mapped on the scale of two miles to one inch. Included within this area is the new Stanislaus Forest Reserve.

About Mt. Whitney an area of 1,800 square miles was mapped, and will be published in two atlas sheets. These maps include Mt. Whitney, the highest peak in the United States outside of Alaska, the elevation of which is now known to exceed Mt. Rainier. The height of Mt. Whitney was obtained by means of a line of precise levels which was checked to the very summit of the peak, and the elevation was determined as approximately 14,500 feet. This is subject to computations now in progress to reduce it more accurately through connecting levels to mean sea-level, which may change it from 4 to 5 feet at the most. Mt. Whitney has been supposed to be an unusually difficult peak to climb; yet the topographers found an easy route by which no difficulty was experienced in running levels and carrying instruments and camp equipment to the very summit.

In the eastern portion of San Diego County, near the Mexican boundary line, west of Yuma, an area of 600 square miles was mapped on the scale of two miles to one inch. This area includes the celebrated Salton Sink, in which is located the new city of Imperial, containing several thousand inhabitants and some handsome building blocks, residences, etc. The Imperial Canal Company, which is interested in the irrigation of this area and is incorporated in Mexico, is composed mostly of American citizens. This company opened the banks of the Colorado River in Mexico, and dug a wide canal to conduct the water into the margin of Salton Sink for its irrigation. Recently, the Colorado River began to erode the sandy margin of the canal, and enlarged it so rapidly that now the whole volume of the Colorado River flows through the opening and into the Salton Sink, which is fast filling. This seriously menaces the homes and property of nearly 8,000 people, residents of the United States, and has caused the submerging and reconstruction of many miles of the Southern Pacific Railroad. A serious problem now confronts the people living in this region, to devise some means whereby the Colorado River may be turned again into its original channel and caused to flow into the Gulf of California instead of into the Salton Sink. The lowest point of the Salton Sink is 275 feet below sea-level, and the mapping of the region is of great engineering and economic importance.

A reconnaissance survey, mapped on a scale of four miles to one inch, and with a contour interval of 100 feet, was extended over an area of 10,000 square miles in California and Nevada, covering the region extending south from the important mining developments about Tonopah and Gold Fields. This will be of interest in connection with geologic studies made of this region to develop the trend of the rich gold deposits being discovered. A special map was made of the mining development about the new Eldorado at Gold Fields and Bull Frog, the scale of the maps being 2,000 feet to one inch, and the study of the geology of these localities is about to be undertaken.

In Arizona the surveys commenced a year ago near Bright Angel, in the Grand Cañon of the Colorado, were extended westward, and covered the Shinumo sheet, an area of 250 square miles being mapped on the large scale of 4,000 feet to one inch, with a contour interval of 50 feet. This sheet and the Bright Angel and Vishnu sheets, which were mapped during previous seasons, contain some of the most interesting and intricate topographic forms ever mapped. Depths of thousands of feet are shown in such detail as fifty-foot contours will permit. The first of these sheets to be published will be the Bright Angel, the engraving of which is nearly completed, and will be soon available to the public. Thousands of persons visit this remarkable region each year. In southern Arizona a special map on the large scale of 2,000 feet to one inch was made, covering an area of 40 square miles about Tombstone. This is to serve as a basis upon which to study with greater detail the economic geology of this important region.

A portion of the Uinta Indian reservation in Utah, covering about 300 square miles, was mapped on a scale of 2 miles to one inch. This reservation has been recently opened up for settlement, and the resulting maps will be valuable in connection with its development, which will now go on at a rapid pace. This map also covers the Uinta Forest Reserve. In the southwestern portion of Utah, in Beaver County, a special map has been made of an area of 225 square miles on a scale of one mile to one inch. In the extreme southwestern Utah an area of 200 square miles was mapped east of St. George, in Iron County, on the scale of one mile to one inch, with a view to the future study of the economic resources of the new iron ore body recently discovered in the vicinity of Iron Springs. This entire region, from central Utah southwestward through Nevada to southern California, is destined to see a remarkable change within a few years as a result of the new Los Angeles, San Pedro and Salt Lake Railway, which completes an additional transcontinental connection to the coast. From Salt Lake City this railway runs through the most arid and least-known portion of the United States. It skirts Death Valley, running near the celebrated borax deposits of the Amargosa Valley and extensive gypsum deposits near the bend of the Colorado in the neighbourhood of the Las Vegas. As this region has recently seen some finds of rich gold-bearing quartz and other precious metals, it is doubtless destined to be the scene of the discovery of additional deposits of the precious metal.

In the neighbourhood of Boulder and Greeley, Colorado, about Fort Collins, about 400 square miles were mapped on the scale of one mile to one inch. This region is especially important now, in view of the reclamation projects which are destined to develop its agricultural resources to even a greater extent than heretofore.

In southwest Colorado the San Cristobal sheet, covering an area of 900 square miles, was mapped on the scale of two miles to one inch. This is immediately south of the celebrated gold region of Creede and between it and Silverton, and the map of this country will aid in the study of the resources of a district which promises to afford important mineral development.

A belt of primary triangulation was extended through the Priest River Forest Reserve in northern Idaho, and will be followed shortly by detailed topographic mapping of this Reserve. Near Lake Pend Oreille a portion of the Cataldo quadrangle, covering an area of about 250 square miles, was mapped on the scale of two miles to one inch. This is also a promising region for future mineral development, lying as it does northwest of the Cœur D'Alene district.

The Yellowstone Forest Reserve has been partially mapped during the past season. Nine hundred square miles of its area lying outside of the Yellowstone Park were mapped on the scale of two miles to one inch. This area includes Younts Peak, one of the highest mountains in this region, and a rival of the celebrated Tetons near Jackson Lake. In Carbon County, Wyoming, an area of 400 square miles, covering a portion of the Medicine Bow sheet, was mapped on a scale of two miles to one inch. In addition, primary triangulation was extended over portions of Fremont and Uinta Counties, over the extremely elevated region along the headwaters of the John Day, Green, and Wild Rivers. In this area is the head of the Snake River, which flows into the Columbia and thence into Puget Sound; the Green, which flows into the Colorado and thence into the Gulf of California, and the Platte and Big Horn Rivers, which flow into the Missouri and thence into the Gulf of Mexico.

In South Dakota topographic surveying was continued in the Belle Fourche region, and the survey of Belle Fourche and Indian sheets was nearly completed. These cover 350 square miles on a scale of one mile to one inch, and are important in connection with the development of the irrigation projects now in course of construction by the Reclamation Service, and which will make available for settlement thousands of acres of valuable agricultural land.

In western Texas the Van Horn sheet is now being mapped. By the close of the season an area of 1,000 square miles will have been surveyed on the scale of two miles to one inch. In eastern Texas the Texarkana sheet will be mapped on a scale of two miles to one inch, and it is expected that about 1,000 square miles will be completed in that area during the season.

In connection with delimiting the boundaries of the National Forest Reserves, extensive work was done on the Chiricahua Reservation in Arizona, the entire boundary of which was surveyed and marked with substantial monuments. The boundaries of the Yellowstone National Park were run out in part and carefully marked. In southern California the greater part of the boundaries of the Santa Barbara Reservation were run out and monumented.

THE NORTH EAST PASSAGE.

Mr. J. Herrman, Assistant in the German Hydrographic Office, discusses in the *Annalen der Hydrographie* (No. XI, 1905) the present condition of our knowledge of the navigability of the North East Passage. The question of utilizing this sea route north of Europe and Asia between the Atlantic and the Pacific has been prominent, at times, for three centuries, and is not yet answered. The Russians have recently made considerable progress in the systematic exploration of that part of the route between the White and Kara Seas, but the long stretch between the Kara Sea and Bering Strait is little known. It is highly desirable, therefore, that the intention of the Imperial Russian Society for Navigation to explore the entire North East Passage should be realized.

The efforts of British and Dutch sailors to take their vessels through the North East Passage in the sixteenth century were soon abandoned, and Nordenskjöld was the first, three hundred years later, to make the Passage. During his journey he spent the winter of 1878-79 on his vessel, the *Vega,* in the Arctic Ocean. The Austrian Polar Expedition, under Weyprecht and Payer, had the Passage in view in 1872, when they were caught fast in the ice and drifted to Franz Josef Land.

The entire route may be divided into four sections: The first is Barents Sea, with its southern extension, the Murman Sea, which washes the coasts of northwestern Europe from the North Cape to the Kara Sea; the second is the Kara Sea as far east as Cape Chelyuskin, the most northern point of Asia; the third stretches from Cape Chelyuskin to Bering Strait; and the fourth is Bering Strait.

The route from North Cape to the Kara Sea presents the least difficulty. Owing to the inrush of warmer waters from the Atlantic, this stretch of navigation is free from ice in the latter part of the summer, and may be navigated without danger and with the aid of charts which, on the whole, are reliable.

Four routes lead into the Kara Sea—the Jugor Strait route, between Vaigatch Island and the mainland; the Kara or Vaigat Strait, between Vaigatch Island and Novaia Zemlia; the Matotchkin Shar, which separates the two islands of Novaia Zemlia; and the route around the north end of Novaia Zemlia.

The route around the north end of Novaia Zemlia is open at times about the beginning of September, when it is used by many fishing vessels. There is no doubt that this route, in favourable ice years, may be used for penetrating into the Kara Sea.

The Russian chart of Matotchkin Shar is fairly accurate, and an English chart is also used. There are good anchorages, both at the eastern and western entrances and at other points in the strait. In foggy weather the western entrance is hard to find, owing to the uniform appearance of the coast. The Matotchkin Shar is the shortest route from the North Cape to the Ob and Yenisei Rivers and into the Siberian Polar Sea. It has the additional advantage of being less clogged with floating ice than the Kara or Jugor routes. Its accessibility from the west depends upon the position of the pack ice in Barents Sea. Nordenskjöld recommended the Matotchkin Shar only about the end of August. Earlier in the season both the Kara and the Jugor routes are preferable to the Matotchkin Shar.

The Kara entrance to the Kara Sea is the widest of the three southern entrances (about 37 statute miles), and its depth is sufficient for the largest steamers, as the Russian survey steamer *Pachtusov* ascertained in 1902, when a sounding-rod 36½ meters in length at no place touched bottom. There is a good anchorage, wind-sheltered, and ice-free on the northwest coast of Vaigatch Island.

The Jugor Strait route is most frequented. Its length is about 40 statute miles, with a width of 3 to 7 miles. The course through it is tortuous, but the depths, though not great, are sufficient for the largest steamers. In the strait is an excellent and protected anchorage, Varnek Bay, discovered and surveyed in 1900. The quantity of ice is smaller than in Kara Strait. In 1903 the Russian survey expedition found a new western entrance to Jugor Strait between Cape Medinski Savorot and Maly Selenets Island, which is useful when the usual route to the north is blocked by ice.

The Kara Sea is open to the northeast and merges with the Siberian Polar Sea. It is comparatively shallow, though the water gradually deepens toward the east. Along the coast of the Yalmal Peninsula and near White Island the sea is so shallow that it is best to keep away from this part of the coast. The Kara Sea has a bad reputation on account of its unfavourable conditions. It is usually navigable about August or September, but even then a straight course is not always possible. Ice-free channels along the coast where they exist should be followed unless the prospects outside of them are particularly favourable.

The Arctic Ocean from Kara Sea to Bering Strait is very little known, for not much study has been given to the coast waters, ice, wind, and tidal conditions. There is usually some open water between the pack ice and the coast even in winter, as winds move the ice offshore, occasionally making openings of large extent. Nordenskjöld found the greatest difficulties near the eastern end of this stretch, between the Kara Sea and Bering Strait. He followed the narrow, shallow and winding channel near the coast, making very slow progress till his vessel was finally frozen in a short distance from Bering Strait. In summer there is a great deal of fog both in the Kara Sea and farther east along the Asiatic coast.

The route through Bering Strait is well known, the charts are adequate, and a handbook in English gives detailed information as to the ice, wind, and tidal conditions.

The voyages thus far made between the Atlantic and the large Siberian rivers have not provided conclusive testimony as to the practicability of more or less regular steamship connection between these rivers and the Atlantic ports of Europe; and it is certain that the route can be of very little practical importance either for military or commercial purposes as long as there are no telegraphs, harbours, coaling stations, soundings, lighthouses, or sailing directions for great distances along the coasts.

AMUNDSEN'S NORTH WEST PASSAGE.

A telegram published in the newspapers on Dec. 5 from Captain Roald Amundsen announced his arrival at the mining camp of Eagle in Alaska, to which place he had travelled by dog sledge from Herschel Island west of the Mackenzie delta. He had left the *Gjöa* and his comrades on Aug. 13 in winter quarters at Kay Point near Herschel Island. The party had made their way in the *Gjöa* from King William Land through the channels between the mainland and the islands. They had thus actually made the North West Passage, as their vessel is now in waters frequented every summer by San Francisco whalers. She will resume her voyage when navigation opens, and will pass through Bering Strait on her way home.

Amundsen sailed from Christiania in June, 1903, for the neighbourhood of Boothia, where, on the western coast, Sir James C. Ross, in 1831, determined the position of the North Magnetic Pole. It was Amundsen's purpose to relocate the position of the pole and to make a magnetic survey of that region. After the completion of his magnetic work it was his intention to try to make the North West Passage. His vessel is of 47 tons register, 70 feet long and 20 feet broad, and has a small petroleum motor, by means of which she can make about four knots an hour. Amundsen purposely chose a small vessel as the sounds and straits through which he would have to pass are narrow and likely to be encumbered with drift ice, and a larger craft would be hard to handle.

The weekly edition of the London *Times* printed on Nov. 17 two letters from Amundsen which Eskimos had carried from King William Land, Amundsen's headquarters, to Fullerton on the northwest side of Hudson Bay, where they were delivered to Major Moody of the Canadian Government vessel *Arctic*. These letters give an outline of the work and fortunes of Amundsen's party from the time it left Godhavn until shortly before the start was made through the North West Passage.

Writing on Nov. 24, 1904, from "Gjöa Harbour, King William Land, about 68° 37′ L. N., 95° 45′ L. W. Gr.," Amundsen says they left Godhavn, West Greenland, July 31, 1903, reached the ice in Melville Bay, near "Devil's Thumb," on Aug. 8, and on the 16th and 17th took on board the stores deposited for them on Dalrymple Island. They then entered Lancaster Sound and reached Beechey Island Aug. 22, where they made magnetic observations to determine the direction of the North Magnetic Pole. The results showed that the Pole was to the south, and accordingly they pushed southward down Peel Sound, their compass failing to aid them after reaching Prescotte Island in that Sound. Without compass and in thick fog navigation was uncertain, but they advanced, avoiding the heavy ice floe, and steamed down the west coast of Boothia through a good opening along the land. Simpson Strait was ice free, and on Sept. 9 they anchored under King William Land, and on the 12th reached their winter harbour—Gjöa Harbour (Pettersen's Bay, McClintock). Though small, it was an excellent harbour:

> On Sept. 17th the provisions were landed by the means of a suspension track, and deposited in a house erected for that purpose. In the course of October the house of magnetic variations was built, the meteorological institute with dwelling for two of the party, astronomical observatory, house for the absolute magnetic observations, house for the observations of the inclinations, house for the keeping of the magnetical instruments. The two former are built of cases and very strong. The others are built of snow and sail-cloth. On November 2 all the observations were commenced, and they have been continued without interruption ever since.

Eskimos from the mainland visited the camp on Oct. 29, 1903, and later the party met Eskimos from both the west and east coasts of Boothia. In October 100 reindeer were killed. The winter passed well, though seven of the best dogs died. February was the coldest month, with an average temperature of −40.5° C.:

> Commenced on March 1, 1904, putting down the stores for the coming spring voyage to the vicinity of the pole. Observed during this tour--in the interior of the country--our lowest temperature—−61.7° C. The travel by sledge to the polar region itself was commenced by Ristvedt and myself on April 3 with two sledges and ten dogs, several of which were whelps. I dare not say anything about the result of this tour. Had five stations in all along the west coast of Boothia up to the Tasmania islands. Had to return earlier than originally intended, the Itchuachtorvik Eskimo having plundered our depot. Came back at the end of May. The summer I have spent in magnetical observations around the station. The ice went at the beginning of August, came in October, 1903, and several times was out of sight. The summer was cold and rainy—according to the Eskimo the worst summer they ever had. Lieutenant Hansen and Helmer Hansen, on the breaking up of the ice, 1904, went westward through the Simpson Strait in a boat. The object was to explore the most narrow part of the strait about the Eta Island, and to put down stores for the intended sledge travel to the west coast of Victoria Land in the spring of 1905. They met with much ice on their westward voyage, but it was accessible for a vessel of the size of *Gjöa.* The sea was rather shallow.

The second winter passed with all in good health. The magnetic observations were a large part of the work. Besides the variation instruments which were in constant use, there were daily absolute observations. Observations of the aurora borealis were made in connection with the meteorological work. The variation at headquarters was between N. 10 W. and N. 10 E. They found even greater deviations. Most frequently the variation was about 5 W. The inclination was about 89° 20′. Amundsen added that they had made ample collections of ornithological, ethnographical, and botanical material, and some fossils.

The second letter is dated from headquarters on King William Land May 22, 1905. Amundsen wrote:

> This winter has not by far been so hard as the former. The sea ice, which last year about this time measured about 380 cm., now is no more than about 170 cm. The lowest temperature we had in February −45°. A great number of Netchilli Eskimo stayed here during the darkest part of the winter. The spring made signs of its coming as early as the end of March. The temperature now already has been above zero several times. The health has been excellent all the time. I commenced in February to circle the magnetic station, and have just finished this task. Lieutenant Hansen and Sergeant Ristvedt left here on April 2 to draw a map of the east coast of Victoria Land. They were equipped for 70 days—two sledges with six dogs at each. Fresh meat we have had the whole time—reindeer and salmon.
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> The magnetic variation house has been in uninterrupted activity. Wiik has managed this work, and done it excellently. On the whole, I must add that all and each of the party have done their duty to the utmost. Absolute magnetic observations have been made daily, and at all temperatures. The meteorological registering instruments have been in function all the time. The zoological and ethnographical collections are constantly increasing. The magnetic variation house will be pulled down in the beginning of June after 19 months of uninterrupted activity. As regards the results I cannot say anything.

Amundsen reports from Eagle that he has forwarded the data for his magnetic observations to Dr. Nansen in Norway. It is probable that the results of his work will not be ready to be published for some time.

WILKES LAND.

On the 19th of January, 1840, in longitude 154° 30′ E., latitude 66° 20′ S., Lieutenant Charles Wilkes sighted, or believed that he sighted, land to the south. On the same day, in longitude 153° 40′ E., latitude 66° 31′ S., Lieutenant Hudson also thought he saw land to the south. Other officers, among them Lieutenant Alden, Gunner Williamson, and Passed Midshipman Colvocoresses, made statements to the same effect. The American vessels sailed westward, and on the 22d and 23d of January reported land again. They then continued their cruise to longitude 97° 37′ E. along this coast, which Lieutenant Wilkes named "The Antarctic Continent," and which has since justly been called Wilkes Land.[*]

The moment news came of the return of the British Antarctic Expedition in the Spring of 1904, an article appeared in London[†] denying the existence of Wilkes Land east of 140° E. longitude. Several other such statements were made later, among others one by Captain Scott,[‡] rejecting Wilkes Land to the eastward of the 140th meridian.

In his recent book,[§] Captain Scott emphasizes these statements. First of all, he repeats and reiterates[||] a number of antiquated misstatements about Admiral Wilkes. It is not necessary to discuss these misstatements, as their inaccuracy has been repeatedly shown of late years, and British writers themselves are beginning to fight shy of them. Later on[**] he narrates that on March 3 he had only a bare sufficiency of coal to take the *Discovery* north. On March 4th they sailed to the south of Eld's Peak and Ringgold's Knoll, which they did not see, to longitude 155° 30′ E., 67° 23″ S., and with a dull sky, but a clear horizon, did not see land ahead. Here they turned north, and during the night of March 4-5 they did not see any land to the west. They got soundings in 250 fathoms, 254 fathoms, 245 fathoms, 260 fathoms. Captain Scott, from these observations, deduces that he was on the edge of the Continental plateau; but he concludes that there is no case for any land eastward of longitude 140° E., and he asserts that once and for all he has definitely disposed of Wilkes Land.

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[*] *Narrative United States Exploring Expedition*, Vol. II.

[*] *Antarctica*, by Edwin Swift Balch, pp. 145–156.

[†] *The Geographical Journal*, May, 1904, p. 551.

[‡] *The Geographical Journal*, April, 1905. p. 370.

[§] *The Voyage of the Discovery*, by Captain Robert F. Scott.

[||] *The Voyage of the Discovery*, Vol. I, pp. 17–19.

[**] *The Voyage of the Discovery*, Vol. II, pp. 392–394.

Lieutenant Albert B. Armitage, in his recent book,* makes statements which are much less drastic, and which do not altogether tally with those of Captain Scott. He says that he is sure that he could have seen any high land within fifteen miles, although the weather was not of the kind in which one could see any great distance, and that although he did not see land, yet the soundings—256 fathoms, 354 fathoms, with yellow mud, 284 fathoms with mud bottom, and 264 fathoms—indicated that the land was not far off.

Captain Scott's Chart † shows the track of the *Discovery* sailing almost due west from the 174th meridian to the 155th meridian of east longitude, and at this point—beyond which the outline of Cape Hudson is indicated on the chart—the track of the *Discovery* turns north.

Let us consider these extracts a little. There was a land twenty degrees of longitude distant from Captain Scott, which he was so anxious to expurgate from the map—undoubtedly because it was an American discovery—that he sails nineteen degrees of longitude towards it. The day before reaching it he pretends to have qualms of conscience about his coal—a handy excuse for stopping—and, just before reaching the spot where the land is charted, he stops, alters his course, and steams away. He neither sails over the spot nor alongside; he simply runs away. Nevertheless, he is so determined that this land shall not exist that he says squarely, "thus once and for all we have definitely disposed of Wilkes Land."

It is self-evident that no Continental or American geographer is going to eliminate Wilkes Land from the map on the assertion of a man who has not been there. For whether Captain Scott turned north because—as he suggests himself, and a fine excuse it is for a sailor—he was afraid that he would not have coal enough to steam thirty or forty miles farther, but would have to resort to sails; or whether he thought he would run his ship on to land; or whatever his underlying motive was; the fact remains that he did run away at the crucial moment and that he did not go to Cape Hudson.

It seems, also, that there are British geographers who are not going to eliminate Wilkes Land from the map, to please Captain Scott, judging from the chart in the excellent book of Dr. Hugh Robert Mill.‡ This able and impartial English gentleman, and Mr.

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* *Two Years in the Antarctic*, pp. 293–294.

† *The Voyage of the Discovery:* "Chart of the Antarctic Ocean."

‡ *The Siege of the South Pole*, by Hugh R. Mill, D.Sc., LL.D.: "Chart of the South Polar Regions," by J. G. Bartholomew, F.R.S.E.

J. G. Bartholomew * not only chart Cape Hudson, but they chart Peacock's Bay, Pt. Emmons, Disappointment Bay, Pt. Case, Pt. Alden, Cape Carr, Porpoise Bay, North's High Land, Totten's High Land, Budd's High Land, Knox's High Land, Termination Land, with a query, and the whole is called Wilkes Land. The appearance of the name "Wilkes Land" on this portion of East Antarctica, and especially the appearance, at last, of "Cape Carr," as well as the entire tone of Dr. Mill's well-written and impartial book, are extremely significant, for they show that many English geographers have a high standard of fairness and honour.

And now to take up another phase of this question. The whole of East Antarctica may be one great land mass. Or it may be that Wilkes Land is one mass, possibly a continuation of Australia; and Victoria Land one mass, possibly a continuation of New Zealand. No one can say positively, until an expedition is sent to explore systematically the northern coast of East Antarctica. Mr. Henryk Arctowski, a member of de Gerlache's Antarctica Expedition, is trying hard to keep up interest in Antarctic exploration and to have international co-operation in the future, as he has explained in a recent monograph.† Is it impossible to wake up Governmental interest in the United States in this matter, or, if it is, would not some American multi-millionaire furnish the funds to send an expedition to settle for all time the facts about the greatest geographical discovery of the Nineteenth Century, the coast of "The Antarctic Continent" discovered by Charles Wilkes?

EDWIN SWIFT BALCH.

GEOGRAPHICAL RECORD.

AFRICA.

GAUTIER'S JOURNEY ACROSS THE SAHARA FROM TUAT TO THE NIGER.—Last summer Professor E. F. Gautier, a member of the Faculty at l'École des Lettres of Algiers, crossed the Sahara between Algeria and the Niger River. His route lay between those of Caillié and Lenz in the west and of Foureau and Barth in the east. He is the first explorer to cross this wide part of the desert since Laing was murdered near Timbuktu in 1826; the notes of this journey across the desert were never recovered.

The journey Gautier has made would have been regarded four years ago

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* I have seen it stated recently that Mr. Bartholomew christened the Southern Continent "Antarctica." I am unable to verify the statement, but, if it is correct, he deserves full recognition for coining this excellent name.

† *Projet d'une exploration systématique des Régions Polaires*, par Henryk Arctowski, Bruxelles, 1905.

as a foolhardy undertaking, destined to failure and probably involving the life of the explorer. But Gautier has crossed the Sahara without special difficulty, and for a large part of the way he travelled practically unarmed and accompanied only by a servant and a guide. His immunity from the great dangers that attended earlier explorers is due in part to the development by the French of a system of fast travel by means of specially-trained camels, thus shortening the time required to reach the various oases where supplies may be replenished; and in part to the powerful influence which the French have acquired over the Tuaregs, who have been brought by the energetic policy of Laperrine, the Commandant at the Tuat oases, under complete subjection.

Early in 1904 Laperrine was able, without the slightest interference from the natives, to travel from the Tuat oases through Inzizi and Timisao to the Adrar plateau, where, at the wells of Tinsauaten, he met a French expedition under Captain Théveniaut that had been sent from Timbuktu. It was thus proved that communications were open between Algeria and the French Sudan. Both parties turned back to their starting-points from the place where they met, so that Gautier is the first explorer to cross the entire desert under the improved conditions of travel.

He started in May last from Tuat with the Etiennot party sent out to select a route for the proposed telegraph line across the Sahara. Gautier was well prepared for travel and research in the Sahara by his scientific investigations in the northern part of the desert during the two previous years. A new route was followed to the west of Laperrine's road as far south as Uallen, whence the party travelled east to Adrar Ahnet and then south to Inzizi, and from there continuing along the Laperrine route to Timisao.

At this point, in the middle of the desert, Gautier left the survey party and started with his two comrades on their swift camels. The remaining 600 miles of the journey, to Gao on the Niger River east of Timbuktu, were made by these three men in entirely new territory. Gautier ascended the Niger from Gao to Timbuktu and Bammako, and reached the Atlantic by the railroad from Bammako and the Senegal River. He arrived in Paris early in October, less than six months after starting from the Tuat oases.

Gautier informed the Paris *Temps* that his journey to the Sudan had not been difficult, and that the prevailing view of the Sahara as an impediment to communication was much exaggerated. The most trying and difficult part of the route was that across the Tanesruft district, about 300 miles, but even here the discomforts of the journey were much alleviated by the wells at Inzizi and Timisao.

He says that the Sahara, viewed as a desert, is much less extensive than has generally been believed. The Adrar plateau, from 2,300 to 2,700 feet above sea-level, is not, properly speaking, a waste; and while he was still 360 miles from Gao on the Niger he reached a wide belt of steppe, which is the merging of the Sudan with the Sahara. This steppe region has its rainy season with from 150 to 300 millimetres (about 6 to 12 in.) of precipitation every year. This quantity suffices to cover the land with ponds and grass. Animal life is abundant; he found many varieties of antelopes, and also wild hogs, giraffes, lions, and elephants.

He got on very well with the Tuaregs, who gave him everywhere a hospitable reception. He distinguishes between the Tuaregs who ride on camels and those who use horses; the first inhabit the drier regions, and, thanks to the swift camel-riders (Meharists) of Laperrine, they have been completely subjected; the Tuaregs who use horses, on the whole more numerous, live in the steppe region and along the Niger and are still comparatively independent, for the reason that in the Timbuktu district there are as yet few men for the formation of strong camel corps.

Gautier believes that he has cleared up the mystery relating to the wadys coming from the Atlas ranges of Morocco and the Hoggar Mountains in the desert. In his opinion their courses are all directed to an extensive depression in the desert, of which the saline district of Taodenit is the centre. The salt is obtained by evaporation. Gautier says that at some time not very distant a great lake, similar to Lake Chad, existed in this depression, receiving the waters not only of the wadys pushing out into the Sahara but also of the Niger itself. The courses of these streams were finally blocked by sand dunes.

The explorer found abundant evidences that this part of the Sahara once had a very large population of the Neolithic period of development. His finds included many arrow-points and axes of polished stone. Even the waste regions were inhabitable until a comparatively recent period. Proofs of this are found in the thousands of drawings upon the rocks, the graves in which, everywhere, the same kinds of implements and other objects were found, and the stones used for grinding grain. These stones show that agriculture was practised here, and that civilization was considerably advanced.

The gradual desiccation of this region advanced from the Sudan. To-day, however, the rain-belt is again extending more and more to the north. Gautier distinguishes these three epochs: the first was marked by dense population; the second by desert conditions; and in the third, or present period, the land is again assuming a steppe-like character. The most important geological result of the journey was the discovery of the predominance of Silurian formations. The archæan rocks form only islands. The Silurian strata are extremely distorted, and almost everywhere metamorphosed. He was also able to collect new and precise information concerning the volcanoes of Inzizi and Hoggar.

M. Gautier is now engaged in the preparation and publication of the results of his three years of explorations in Tuat and other parts of the northern desert and of his journey across the Sahara. The above facts are taken from *Globus* (No. 19, Nov. 23, 1905) and from Gautier's note in the *Annales de Géographie* (No. 78).

REPORT OF THE CONGO COMMISSION.—The Belgian Government printed in November the Report of the Commission appointed by King Leopold to investigate conditions in the Congo Free State. The Commission says that, though freedom of trade is formally recognized, there is virtually no trade properly so called among most of the natives. The State is warranted in considering vacant land as belonging to it, but each native settlement should have a zone of sufficient size to meet the agricultural needs and make the natives self-supporting. The question of forced labour is discussed, and the Commission is of the opinion that on this basis alone the natives may be reclaimed from barbarism. The Free State has the right to demand from them co-operation in working out their development; but forced labour must be applied in an equitable and paternal manner, and the remuneration should not be inferior to the price of the labour required. This principle has not always been observed.

The Report sets forth acts of violence by agents in the collection of taxes. The local Government has sent instructions from time to time recommending gentle and humane dealings with the natives, but more efficacious means have rarely been employed. The courts, however, have punished, in conformity with the law, every act of ill-treatment submitted to them.

The amount of forced labour fixed by law is 40 hours per month, but more has often been demanded. The cruelties imposed upon natives have largely grown out of their refusal to give the service required. The resulting abuses, criticised chiefly by English missionaries, have greatly decreased in the regions of Lake Leopold II, Lake Tumba, and in the districts of the Welle and Aruwimi. But the improvement has not been maintained in regions exploited by certain commercial societies, and particularly as regards the Abir Company in the Mongalla district, where the imprisonment of women as hostages, flogging to excess, and various acts of brutality are not contested. The evil is largely due to the employment of native sentinels of a degraded and ferocious nature. The State has made a great advance by forbidding the despatch into the villages of any native member of the public police, unless accompanied by a white man.

The Commission advises that the carrying of arms by native sentinels be abolished, and that the right to use force be denied to the commercial societies. Commercial companies should never be permitted to send out armed expeditions.

After these various criticisms the Commission exhibits a more pleasant side of the picture. Here is an extract from the Report:

> We all thought our mission was mainly to inquire into acts of violence against the natives, or, in other words, to seek out the evil. This would not prevent us from placing on record what seemed to us good. Let us say at the outset that when one travels in the Congo and compares the present with the past the impression is one of admiration and astonishment. In these regions, which 25 years ago were steeped in the lowest barbarism, where a white man carried his life in his hands, where whole tribes were decimated by Arab raids, where traffickers in human flesh marked the choicest morsels on the living victim, where atrocious massacres were of constant occurrence, in this dark and mysterious continent a State has arisen which has introduced the benefits of civilization into the heart of Africa. To-day security reigns in this immense territory, the slave trade has disappeared, cannibalism scarcely exists, human sacrifices are rare. Villages recalling European seaside towns stud the river banks of the Lower Congo. Leopoldville, with its busy traffic, reminds one of the industrial cities of the world.
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> These railway systems both on the Lower and Upper Congo, these 80 steamers which navigate the main river and its tributaries, these 1,200 miles of telegraph, these hospitals and schools, which sprang up as if by magic, give the traveller the impression, not of crossing a continent unknown 25 years ago, but a country long settled under the sway of European civilization. The impression is heightened when one sees the perfection with which the administrative machine works throughout the young state. Boma is in touch with the most distant stations and is the centre of authority, which radiates thence to the extreme limit of King Leopold's territory.

The Report covers nearly 150 pages. The commissioners spent five months in the Congo State studying the situation. As soon as their recommendations and testimony were made known to King Leopold, he appointed a new Commission of fourteen members with instructions to formulate measures rendered necessary by the disclosures in the Report and to suggest practical means of giving effect to these measures.

EXPEDITION TO MOUNT RUWENZORI.—A party started for Central Africa from London towards the end of October for the purpose of spending about two years in the investigation of the flora and fauna of the snowy range of the Ruwenzori Mountains, which are on the boundary between the Uganda Protectorate and the Congo Free State. The party. which consists of H. B. Woosman, Gerald Legge, C. D. Dent, and Mitchell Carruthers, goes out under the auspices of the Natural History Department of the British Museum. It is hoped that the expedition will complete the geographical exploration of this region.

Electric Power from the Victoria Falls.—The African Concessions Syndicate has consulted with leading American and European engineers concerning the transmission of power from the Victoria Falls of the Zambezi to the gold mines of the Witwatersrand. These authorities say that the scheme is feasible and would be commercially successful. The climate is suitable for the transmission of power. There is no ice to interfere with the turbines, no snow to break down the wires and the extreme dryness is favourable for long-distance transmission. Even in the driest season sufficient water goes over the Falls to produce 500,000 horse-power, while at present the Rand only consumes 150,000 horse-power. If more than this is needed additional power may be obtained by cutting a canal 15 to 20 miles in length to a point lower down where there would be a head of 1,000 feet, which would be sufficient to produce 1,000,000 horse-power. The needed power could be supplied to the mines in this way more cheaply than by any other method. At present over $15,000,000 is spent annually to produce power on the Witwatersrand. The engineers say that the beauty of the Falls would in no way be impaired.—*Reuter's Agency.*

AMERICA.

Mexican and Central American Antiquities.—English-speaking students of aboriginal American history have given much attention for some years to the archæology and especially to the glyphic writing of the semi-civilized peoples of middle America. The facts relating to glyphic writing are especially important, both in their bearing on native history and in their application to the origin and development of writing in general. Much of the literature on this subject has been published in foreign languages. Mr. Charles P. Bowditch, of Boston, decided to undertake the translation of some of the more important papers, and it was arranged that the translations should be brought out by the Bureau of American Ethnology. They now appear in Bulletin 28 of the Bureau. The 24 papers translated from the German fill, with illustrations and index, 682 pages. The authors are E. Seler, E. Förstemann, Paul Schellhas, Carl Sapper, and E. P. Dieseldorff. The titles include "The Mexican Chronology with special reference to the Zapotec Calendar," "Antiquities of Guatemala," "Wall Paintings of Mitla," "Maya Chronology," "The Central American Calendar," and "Comparative Studies in the Field of Maya Antiquities."

Report of the Isthmian Canal Commission, 1899-1900.—The work of this Commission and its conclusions were summarized long ago, though its *Report* has only recently been issued from the Government Printing Office, Washington. Professor Emory R. Johnson, a member of the Commission, contributed to the Bulletin in 1903 a comparison of distances by the Isthmian canals and other routes (p. 183) and a study of the commercial aspects of the Panama Canal (p. 481). The quarto volume of the Report is accompanied by 86 plates giving panoramic views, profiles, plans of the proposed Panama and Nicaragua Canals, and maps of rainfall areas, steam and sailing routes and of the economic aspects of all the countries that would be chiefly affected by the opening of an Isthmian canal. Many of the maps are on a much larger scale than is required to show the data clearly, but, on the whole, these sheets are valuable additions.

Present Condition and Future of the Klondike.—Mr. R. G. McConnell has written a comprehensive report on the Klondike gold fields which is issued in advance of Vol. XIV of the Annual Report of the Geological Survey of

Canada, in which it will appear. He says that the gold production of the Yukon Territory from the discovery of the Klondike gold fields in 1896 to and including 1903, is estimated by the statistical branch of the Survey at over $96,000,000. The annual production has been as follows:

1896	300,000	1900	22,275,000
1897	2,500,000	1901	18,000,000
1898	10,000,000	1902	14,500,000
1899	16,000,000	1903	12,500,000

All of this gold, excepting about $1,000,000 credited to smaller camps, was obtained from the Klondike creeks and benches and principally from the Bonanza, Eldorado, Hunker, and Dominion creeks, and the Bonanza benches. The dwindling production since 1900, in spite of the increasing use of machinery, is largely due to the gradual exhaustion of the phenomenally rich portions of Eldorado and Bonanza creeks and of the richer Bonanza benches, and does not mark a corresponding decline in the mining industry of the region. The number of creek claims worked and the amount of gravel handled has increased, if anything, in recent years, and the decreasing production must be attributed to the lower grade of the gravels mined.

The centre of mining activity on the various creeks has moved steadily downward towards the wider and leaner gravel beds in the lower parts of the valleys, but none of the principal creeks has been abandoned or will be for some years yet.

While the richer portions of the principal creeks show signs of exhaustion, there still remain considerable stretches of unworked gravel on all the producing creeks rich enough to work under present conditions by ordinary placer methods. The industry, therefore, although it is bound to dwindle, will last for a number of years, probably for a decade at least, even if no further important discoveries are made. Placer mining in the future will be supplemented in the Klondike by hydraulic mining on a large scale. The white channel gravels along Bonanza and Hunter creeks are ideally situated for work by this method. The volume of this deposit on these two creeks and their tributaries is estimated at about 450,000,000 cubic yards.

ECONOMIC GEOLOGY IN PERU.—The Society has received *Boletín* No. 26 of the Cuerpo de Ingenieros de Minas del Peru, a Bureau created in 1902 by the Government of Peru to investigate the natural resources of the Republic. These bulletins, issued at frequent intervals, are illustrated with maps and photographs, and contain much varied information concerning mining surveys and development.

This scientific organization became a necessity on account of the rapid development of the various mining industries. Accordingly, in 1902 the "Cuerpo" was established to locate and fix boundaries of mining claims, collect statistics relating to the production and values of ores and accumulate data concerning the geology, mineralogy, and geography of the country. It was soon found that the subjects and projects demanding immediate and serious consideration were so numerous and varied that it was advisable to classify the work and distribute it among independent committees in the "Cuerpo."

Each of these committees has its responsible chief, and one or more assistants. Among the chiefs are four American specialists: Dr. George T. Adams, in charge of underground waters: M. H. Hurd and Charles W. Sutton, for engineering and topographic work; and V. F. Marsters, for economic geology. The Bulletins may be obtained by applying to the Director, Señor Denegeri, at Lima, Peru.

DISEASE AND WEATHER IN THE UNITED STATES.—From the earliest times there has been a prejudice in favour of an influence of climate and weather upon disease, and although modern views concerning the causes of disease have modified most of the older ideas, there are still certain relations between meteorological conditions and health which are readily observable. The section on vital statistics of the *Statistical Atlas* of the Twelfth Census of the United States gives some interesting charts and diagrams in this connection. The mortality statistics of the Twelfth Census relate to the census year June 1, 1899, to May 31, 1900. The registration area included the New England States, New York, New Jersey, Michigan, and the District of Columbia, together with 153 cities of 8,000 inhabitants or over in other States. Among the more striking facts brought out in this investigation the following may be mentioned: The highest death-rate from consumption in cities (21.1) was in March, and the lowest in June (14.7), while in rural districts the highest rate was in May (13.4) and the lowest in September (9.4). Diphtheria in cities had the highest death-rate (4.8) in December, and the lowest (2.4) in August, while in rural districts November, December, and January had the maximum and June the minimum. The maximum rate from influenza in cities was found in March and the lowest in July, August, and September (8.6 and 0.1). April showed the highest death-rate from influenza in rural districts (11.7), and August and September the lowest (0.3). Diseases of the nervous system, of the circulatory system, and of the respiratory system all show maximum death-rates in March and the minimum in summer or autumn. The determining controls in these winter or spring maxima and warm-season minima are essentially two. During the colder half of the year our sudden, frequent, and violent weather changes, especially when accompanied, as they usually are, by strong winds, act unfavourably upon the organs of respiration, upon nervous disorders, and upon the circulatory system. Further, the inclemency of the weather keeps people indoors much of the time; windows are kept closed; ventilation is bad; less attention is paid to personal cleanliness among the poorer classes; there is more crowding together under unhygienic surroundings. Hence, the opportunity for the spread of contagious diseases is then at its best, as the indirect result of meteorological conditions, rather than as the direct result of cold upon the specific cause of the diseases. Measles and scarlet fever are naturally at a maximum under the conditions of our winter life, and while influenza is probably independent of weather and climate in any direct way, it is spread most easily in the colder season for these same reasons.

Typhoid fever, on the other hand, malaria, and diarrhœal diseases show, as usual, a tendency to maxima in the warmer months, especially in the two last-named groups. High temperatures, either directly in their effects upon the specific cause of the disease, or indirectly in hastening the fermentation and decay of food products, naturally bring on an increased frequency of bowel disorders. Cholera infantum has long been one of the chief causes of the general summer maximum death-rate, which is commonly noted together with a general winter maximum.

R. DEC. W.

MOUNT WHITNEY AND MOUNT RAINIER.—A correspondent writes from Boston:

> . . . In the new edition recently published of Stieler's Hand-Atlas, the height of Mount Rainier in Washington is put down on maps 85 and 86 as 4,707 metres, or 15,298* feet, and that of Mount Whitney in California on map 89 as 4,540 metres, or 14,755* feet. This would make Rainier the highest mountain

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* These heights should read: Rainier, 15,443 feet Whitney, 14,895 feet.

> in the United States outside of Alaska; and both these measurements considerably exceed those accepted by the U. S. Geological Survey, which are given me as 14,363 feet for Rainier, and 14,499 for Whitney.
>
> Again, in the New International Encyclopedia (1903) Rainier is called 14,526 feet, and Whitney 14.898 feet high.
>
> How are these discrepancies to be accounted for? . . . What are the possible authorities for these new measurements?

In a second letter this gentleman puts down the measurements which he has been able to find as follows:

	Whitney.	Rainier.
U. S. Geological Survey...	14,499 ft.	14,363 ft.
Lippincott's Gazetteer, 1905.........	14,502 (14,898)	14,526
New International Encyclopædia, 1904.	14,898	14,526
Stieler's Hand-Atlas, 1905...........	4,540 m. (14,755 ft.)	4,707 m. (15,298 ft.)
Meyers “ “ “	“	“

In Stieler's Hand-Atlas, edition of 1878, the heights of these mountains are given in English feet: Rainier, 12,360 feet; Whitney, 14,100 feet. In the edition of 1881 there is no change in the altitude of Mount Rainier, but Mount Whitney appears, for the first time, with the height of 14,898 feet. This was the elevation determined barometrically by the Geological Survey of the State of California.

In 1864 Mr. Clarence King, then attached to the California Geological Survey, climbed Mt. Whitney to the height, as he estimated it, of 14,740 feet; between 300 and 400 feet below the summit. Later calculations, revised by the Survey, made the altitude of the mountain 14,898 feet.

Mount Rainier was measured in 1870 by Messrs. Davidson and Lawson of the U. S. Coast and Geodetic Survey and fixed at 14,444 feet. This is the height given in Stieler's Atlas in 1891 and 1896.

In the *Dictionary of Elevations and Climatic Register of the United States, by J. M. Toner, M.D., New York, D. Van Nostrand, 1874,* the altitude of Mount Whitney is 15,086 feet, and that of Mount Rainier 14,500 feet. Authorities are not given.

In 1872 Prof. Cyrus Thomas prepared for the U. S. Geological Survey of the Territories the first of a series of Lists of Elevations, continued in 1873, 1875, and 1877, by Mr. Henry Gannett. These Lists were succeeded by the Dictionary of Altitudes, compiled by Mr. Gannett and published by the U. S. Geological Survey in 1884, 1891, and 1899. In these Lists and Dictionaries the height of Mount Rainier is put at 14,444 feet, except in the Dictionary for 1899, where it appears as 14,526 feet, the "mean of authorities."

The recognized authority for the height of Mount Whitney is the Geological Survey of California, and its measurement of 14,898 feet is adopted except in the List of Elevations for 1875, where the figures given, still on the authority of the Survey, are 14,887.

The authority for the height of 4,707 metres (15,443 feet), ascribed to Mount Rainier in Stieler's Hand-Atlas for 1905, does not appear. Not improbably the figures are the result of an error in converting the well-known measurement of 14,444 feet into metres. The elevations determined by the U. S. Geological Survey in the summer of 1905 are to be accepted as final. They are: for Mount Whitney, 14,499 feet; for Mount Rainier, 14,363 feet.

THE NORTHERN ADIRONDACKS.—Under the auspices of the New York State Geological Survey, Kemp, Smyth, and Cushing have been engaged in a study of the Adirondack region for a number of years. In a recent Bulletin of the New York State Museum (Bull. 95, 1905, pp. 271-453), Cushing has published a full account of his work in the Northern Adirondacks. In this report he outlines the geological history as he interprets it, beginning with the pre-Cambrian condition and bringing the history down to the present time. Before the Cambrian there was a land area composed of old sediments and great igneous intrusions, together with rocks of doubtful age, which underwent a complex history too obscure for definite interpretation at the present time; but there was, toward the close of pre-Cambrian time, a long erosion interval, which left the land greatly lowered and with a subdued topography. Subsidence initiated the Paleozoic, and the subsequent history of the Adirondacks has been a succession of changes of level with accompanying deposition of sediments when lowered, and renewed denudation when uplifted. There have also been periods of renewed igneous activity. The details of this history are numerous, and, so far as worked out, are stated by the author. The last great episode in the history of the Adirondacks was the glacial invasion, with which the author was less concerned than with the bed-rock geology; but he briefly states a number of interesting points—for example, that there were local glaciers in the waning stage of the ice occupation, and that glacial erosion has profoundly modified the topography of ridges on the northern slopes. Cushing's paper is divided into three parts: Summary of Geologic History, The Rocks, and Topography. The second of these is much the more detailed, but to the geographer the first and third are of most interest, and in them the author gives a very clear idea of the evolution of the Adirondack topography. R. S. T.

THE CHAMPLAIN AND HUDSON VALLEYS.—From 1900 to 1903, Prof. J. B. Woodworth has been engaged in a study of the Quaternary geology of the Hudson-Champlain Valley, the result of which has recently been published by the State (Bull. 84, N. Y. State Museum, 1905, pp. 65-265), making the most important contribution to that subject so far presented. The Hudson occupies a gorge cut in a broader, more open valley developed in an earlier cycle. The bottom of this gorge is below sea-level, and its top is bordered by rock terraces of fairly uniform elevation, representing the floor of the older valley. During the maximum extension of the last ice advance, the valley was completely occupied by ice as far as Staten Island; but as the ice was receding from the continent there was a succession of changes of marked complexity, some of which Prof. Woodworth has deciphered. In general, the history of ice recession consisted of a protruded ice tongue down the valley, taking positions successively farther and farther north, and with accompanying conditions of frontal and lateral deposits of gravel, sand, clay, and till. Some of these deposits were in the form of deltas, some were terraces built by marginal drainage, some the result of filling of marginal lakes. The paper discusses the deposits of the valley in detail, and, where possible, assigns their origin.

With continued recession a terminal lake, called Lake Albany, developed with an ice dam on the north and a land dam on the south, due to the fact that the land in the north was then depressed so that there was an upward slope seaward where now the river bottom is so level that the sea enters it. Other lake stages succeeded, and finally the well-known connection of the depressed Champlain Valley with the St. Lawrence Sea, proved by marine clays, beaches, and fossils. The evidence for this is fully presented. At the international boundary line the sea rose over land now 450 feet above sea-level.

It has been a quite general belief that the lower Hudson Valley was submerged beneath the sea during the closing stages of the Glacial period, and that the Hudson Valley clays are a result of this submergence. Woodworth takes the view that the lower Hudson Valley region was really higher and has been depressed in post-glacial time. His belief is based upon a number of considerations, among which are the absence of recognized shore-lines and of marine fossils, which are so evident in the Champlain region. Probably most students of the subject will accept this result of Woodworth's studies.

Altogether the paper presents a body of exceedingly valuable facts and an interpretation of the recent history of the valley. R. S. T.

U. S. BOARD ON GEOGRAPHIC NAMES—DECISIONS, December 6, 1905:

* AFTON: Postoffice and railroad station, Greene County, Tenn. (Not Home.)

BEAVER: Brook, tributary from north to Souhegan River, Hillsboro County, N. H. (Not Quohquinapassakessamanagnog, Quonquinapassakessananagnog, Quohquinapassakesanannaquog, nor Quoh-quinna-passa-kessa-na-nag-nog.)

BONNETERRE: Postoffice and railroad station, St. Francois County, Mo. (Not Bonne Terre nor Bontear.)

COUNTY LINE: Creek, tributary from southeast to Tallapoosa River, Chambers and Tallapoosa Counties, Ala. (Not Moore, Moore's, Moores, Mooses, nor Ware.)

FLATHEAD: Indian reservation, Flathead and Missoula Counties, Mont. (Not Jocko.)

GOLD HILL: Postoffice and railroad station, Lee County, Ala. (Not Gold Mine, Gold Ridge, nor Goldhill.)

GRINDLE: Creek and pocoson, Pitt County, N. C. (Not Grindell nor Grindool.)

GRINDOOL: Postoffice and railroad station, Pitt County, N. C. (Not Grindle nor Grindell.)

* KINGS: River, Fresno County, Cal. (Not King nor King's.)

LA PLATTE: River, tributary from east to Lake Champlain at Shelburne, Chittenden County, Vt. (Not La Platt, La Plotte, Laplátte, Laplop, Laplot, Laplotte, Platt, nor The Plot.)

LOBLOCKEE: Creek, Lee County, Ala. (Not Big Loblockee, White's, nor Whites.)

PEMEBONWON: River, Marinette County, Wis. (Not Pembinbemon, Pembine, Pembinebemon, Peme Bon Won, Penne Bon Won, nor Pike.)

SCUPPERNONG: Creek, Waukesha County, Wis. (Not Scupernong.)

SOUTH SANDY: Creek, Chambers and Tallapoosa Counties, Ala. (Not Oaktazaza nor Sandy.)

STURDIVANT: Railroad station, Tallapoosa County, Ala. (Not Sturdevant.)

UNCANOONUC: Mountains, Goffstown, Hillsboro County, N. H. (Not Uncanodnuck, Uncanoonuck, nor Unkonoonuc.)

ASIA.

DR. SVEN HEDIN'S NEW EXPEDITION TO ASIA.—Dr. Sven Hedin reached Constantinople on Oct. 21 and left a few days later for Tiflis, Erivan, Tabriz, and Teheran, for the purpose of organizing a caravan to explore and survey the

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* Reversal of former decisions.

Dashtikavir and the Dashtilut salt deserts of eastern Persia, which are still practically unknown. The present winter will be passed almost entirely in these deserts, though the explorer will keep in touch with the oases and water springs. Dr. Sven Hedin expects to complete this work early next spring and will then go to India, where he will organize an expedition to Tibet to explore its unknown highlands; in other words, he will endeavour to fill up the gaps on our present maps. The Indian Government has promised to afford him every facility, and he will have the best instruments for geographical surveying and astronomical observations.

ETHNOLOGICAL SURVEY OF THE PHILIPPINES.—Part I of the fourth volume of the scientific studies edited by the Ethnological Survey of the Philippines is a series of papers on Moro history, law and religion, the results of original study and translations from Moro texts by Dr. Najeeb B. Saleeby. The history of Mindanao prior to the advent of Islam, says Dr. Saleeby, is traditional and mythological, and no effort has been made to put it on record. With Islam came knowledge, art, and civilization. The Tarsila, or genealogies written in the Magindanao dialect with Arabic characters, contain the lineages of the Datus. They are limited in scope and very concise in the narration of events; but as they are our only source of written information on the early history of the Moros, they are valuable.

The original manuscripts could not be bought, but exact and true copies of them were secured and translated. Reduced photographs of some of the manuscripts illustrate the book. The Moros have hitherto kept these documents away from all foreigners and non-Mohammedans, but their attitude has recently changed. The translations throw considerable light upon their code of laws, religion, and the rulers and conquests of the Mindanao Moros.

The writer says that the word "Mindanao" is derived from the root "danao," which means inundation by river, lake, or sea. The derivative "Mindanao" means "that which is inundated." This is a very appropriate name, for, more than ten miles from the sea, the Rio Grande, aided by the rise of the tide, periodically overflows its banks, floods all the adjacent lands, and in the rainy season this inundation extends farther up and includes an extensive tract of country.

EUROPE.

HELIGOLAND DISAPPEARING.—The *London Standard* says that the sea is making further encroachments on Heligoland. Since the island was ceded to Germany, in 1890, it has lost a considerable area, not alone through the collapse of the sandy cliffs, which surround its shores, but also through a definite sinking on its south side. Engineers have been at work since the cession in a continuous endeavour to safeguard the island from demolition, and considerable work has been performed in filling crevices in the rock, while breakwaters have been built to break the force of the sea. It has been found, however, that the very sea-floor on which these are constructed is without stability, and it is believed that the work can only serve to delay the encroachment of the sea on the friable cliffs. The island has now a circumference of a little less than 3 miles, as against 3¾ miles in 1890. It has little importance, and is known chiefly as a watering-place. Its population numbers about 2,000, and the natives of Heligoland are creditably known among the North Sea and Baltic pilots.

OCEANOGRAPHY.

Exploration of the Sea.—The International Committee for the Study of the Sea has issued its first *Report* (Rapports et Procès-Verbaux, Vol. III, English Edition, Copenhagen, 1905) on the results of the investigations during its first two years ending July, 1904.

In each of these years the general aims and methods of the investigations were the subject of special reports; and a number of scientific reports (Publications de Circonstance), such as "The Literature of the Ten Principal Food Fishes," "On the Spawning of the Cod," etc., were published. The national committees of the nine participating States around the North Sea are studying the hydrographical conditions and the biology of food fishes and plankton under the direction of the International Council and the Bureau it established in Copenhagen.

In the hydrographical work, soundings and water and plankton samples are taken simultaneously at fixed stations and at different periods of the year. The seasonal cruises are made in the beginning of February, May, August, and November. The aim is to determine the changes during the year in the hydrographical conditions, the distribution of the plankton, and also to some extent the distribution of fish eggs, larvæ, and young fish floating in the sea. Practical fishery experiments are carried on in each season of the year in cruises lasting from several days or weeks to months.

The study of the occurrence and distribution of the forms of life which constitute the plankton has made great progress. Plankton nets have been used at every station during the seasonal cruises, and both the surface and the deeper layers of the sea have been investigated. The very rich material thus collected has been worked out after each cruise by specialists of the various countries. Almost all the species were determined, and the descriptive lists published at Copenhagen in the *Bulletin* fill about 350 closely-printed pages.

The distribution of the plankton is by no means uniform. The Arctic waters are rich with animal life in summer, especially near the coasts. On the other hand, there are regions, as over the Faroe-Iceland Ridge, that are particularly poor in plankton.

The *Report,* which is illustrated with charts and diagrams, is chiefly given to 10 appendices published in the name and under the responsibility of the authors and relating to various problems. Among these contributors Dr. Otto Pettersson treats of variations in the Atlantic current and their bearing on meteorological and biological phenomena, and a number of writers deal with the fisheries and biological investigations.

POLAR.

The Mylius Erichsen Expedition.—Some further details have come to hand regarding the plans of this expedition (see Bulletin, p. 554, Sept., 1905). The *Scottish Geographical Magazine* (Dec., 1905) says the intention is to start about the middle of June, 1906, on board the *Denmark,* the party consisting of twenty-one persons, among whom will be a zoologist, a painter, a doctor, a botanist, and a biologist. Seventy sledge-dogs and some motor boats are to be taken. The vessel is to be steered for the east coast of Greenland, and it is hoped that a harbour may be found in lat. 70°. From this harbour an expedition consisting of twelve men with sledges and dogs will start in March, 1907, for the extreme north, where its members hope to map part of the unknown coast of eastern Greenland. This party is expected to return in July, 1907, and, if conditions are favourable, it is contemplated that another party may be sent into the interior, or may even attempt to cross the country from east to west in a high latitude, say, along the 70th or 75th parallel. The expedition is expected to return finally in the summer of 1908, and the sum of £11,000 is given as its probable cost.

VARIOUS.

Volcanic Activity in Samoa.—Our Consul at Apia, Samoa, reported in September that between Aug. 2 and 4 last a new volcanic outbreak occurred in the island of Savaii, about eight miles east of the old volcano Mangi and 10 miles south of Matautu. The activity of the new volcano was phenomenal, for in a fortnight it created a new mountain with three peaks, one of which was about 2,000 feet above sea-level. The ejected matter represents many millions of tons of rocks, slag, cinders, and ash. At the beginning of the outbreak this mass was moving towards the sea, or, in other words, towards the settled part of the island. When the Consul wrote, however, the mass had come practically to a standstill, and it then measured about five miles in length and one-fourth of a mile in width.

A further eruption took place on Aug. 21. It was preceded by a violent earthquake shock, which destroyed a large number of buildings, and an enormous quantity of material was ejected. Dr. W. H. Solf, the German Governor of Samoa, reported on Sept. 17 that the volcano was still active and was visible at Apia, fifty miles away.

Shells as Money.—The late Prof. Dr. Oskar Schneider, of Dresden, left at his death the manuscript for a book in which he gave the results of his long study of the use of kauri and other shells as money. The manuscript was edited by Carl Ribbe, the ethnologist, and has just been published by the Geographical Society of Dresden under the title of "Muschelgeld-Studien." The volume has 190 pp., including index and 16 pp. of plates showing many strings of different kinds of shell money. The book treats of the distribution and uses of shell money, its manufacture, etc., among the islands of the Pacific and in Africa. Mr. Ribbe's two years' experience in the Solomon Islands enabled him to add some facts to Dr. Schneider's work. The book may lead to further studies of this subject, before these forms of money completely disappear in the face of more convenient mediums of exchange.

Anniversary of the Scottish Geographical Society.—The twenty-first anniversary of the Royal Scottish Geographical Society was celebrated by a dinner in Edinburgh on Monday, November 27.

A Gold Medal for Director Walcott.—The Academy of Natural Sciences of Philadelphia on Nov. 7 voted the Hayden Memorial Gold Medal to Charles Doolittle Walcott, Director of the United States Geological Survey, in recognition of the value of his individual contributions to geological science and of the benefits derived from his able and conscientious discharge of the official trust confided to him.

American Geographical Society—Transactions of the Society, November, 1905.—A regular meeting of the Society was held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, November 28, 1905, at 8.30 o'clock P. M.

Secretary Raven in the chair.

The following persons, recommended by the Council, were elected Fellows:

Alzamore H. Clark,
Marcel Pietrzycki,
John Davenport Wheeler,
Richard B. Potter,
Wolfred Nelson,
William Douglas Pickett,
William P. Potter,
E. R. Feeny,
Herbert Parsons,
Robert Brewster Stanton,
John B. Farish,
F. Aug. Heinze,
John Henry Hammond,
Frederic Ashton de Peyster,
Samuel W. Marvin,
Henry St. Clair Putnam,
Herschel C. Parker,
Daniel W. Iddings,
Andrew S. Iddings,
George Carroll Curtis,
William C. Tucker,
Carl Eickemeyer,
Casper Whitney,
Charles H. Fahs,
William S. Thomas,
S. Reed Anthony,
Perry Belmont,
Heber R. Bishop,
Davenport Brown,
Stephen N. Bond,
Willis A. Briscoe,
Clinton T. Bissell,
H. D. Bushnell,
Ammi Brown,
Parker Corning,
A. Walpole Craigie,
A. Bleecker Banks,
William Griggs Shailer,
Harvey D. Cowee,
John Armstrong Chanler,
J. Benjamin Dimmick,
Robert E. Dowling,
John L. Buel,
Robert D. Carey,
Frank E. Clark.

Mr. Francis M. Bacon then offered the following amendment to the By-Laws of the Society:

Amend Chapter 1, Section 5, so that it shall read:

> The name of any Fellow or Member may be dropped from the list by a vote of the Council and without reference to the Society.

It was moved and seconded that the proposed alteration be referred to the Council for consideration and report; and it was so voted.

The Chairman then introduced Mr. Bailey Willis, of the United States Geological Survey, who addressed the Society on his Experiences among the Chinese. Stereopticon views were shown.

On motion, the Society adjourned.

NEW MAPS.

AFRICA.

Congo Free State.—Région Minière du Katanga. Scale, 31 statute miles to an inch. *Le Mouve. Geog.*, No. 47, 1905, Brussels.

A black-and-white sketch map of interest, because it gives the latest information as to the distribution of gold, copper, and other metals in this promising mining region; also the route surveyed by the Katanga Railroad Commission.

AMERICA.

U. S. Geological Survey Maps.

The following five maps accompany Water-Supply and Irrigation Paper No. 137 entitled "Development of Underground Waters in the Eastern Coastal Plain Region of Southern California," by Walter C. Mendenhall:

Plate I.—Map showing the Artesian Areas and Hydrographic Contours in the Valley of Southern California. Scale, 1:250,000, or 3.95 statute miles to an inch. Washington, 1905.

Plate II.—Map showing Irrigated Lands, Canals, and Pumping Plants in the Anaheim Quadrangle. Scale, 1:62,500, or 0.9 statute mile to an inch.

Plate III.—Map showing Irrigated Lands, Canals, Drainage Districts, and Pumping Plants in the Santa Ana Quadrangle. Scale, 1:62,500.

Plate VI.—Map showing Wells, Artesian Areas, and Water-Levels in the Anaheim Quadrangle. Scale, 1:62,500.

Plate VII.—Map showing Wells, Artesian Areas, and Water-Levels in the Santa Ana Quadrangle. Scale, 1:62,500.

The data were compiled under Mr. Mendenhall's direction. Irrigation engineering and water development are further advanced in California than in any other part of the Union, and the scientific study of water conservation and distribution has been carried out in no other part of the State so fully as in the valley region near Los Angeles. These maps relate to the low lands to the southeast of that city. Plates II and III show the areas irrigated in the spring of 1904 and the pumping plants and distributing systems by which the water is secured and conducted over the land; plates VI and VII show the areas of artesian water-bearing land at the beginning of 1904 and give other information concerning the artesian belt; plate I shows the relation of this area of irrigation to other areas in the Valley of Southern California.

Similar maps accompany Water-Supply and Irrigation Papers Nos. 138 and 139 on "The Central and Western Coastal Plain Region of Southern California."

Land Classification Map of Part of the Southern Appalachian Region. Scale, 1:375,000, or 5.9 statute miles to an inch. Washington, D. C., 1904.

Six tints show the cleared lands and areas yielding different quantities of lumber per acre. The contour interval is 200 feet. Illustrating Professional Paper No. 37, "The Southern Appalachian Forests."

Also accompanying Professional Paper No. 37 is a relief map of the Southern Appalachian Region showing the distribution of the mountains by light and shade effects. Scale, 18 statute miles to an inch.

U. S. HYDROGRAPHIC OFFICE CHARTS.

PILOT CHART OF THE NORTH PACIFIC OCEAN, JAN., 1906.—Includes charts published, cancelled, and corrected, from Nov. 1 to Nov. 30, 1905, the average meteorological conditions in January, lines of equal magnetic variation, and (on the reverse) the Storm Signal Code of the Imperial Maritime Customs (Shanghai, China), to come into force on Jan. 1, 1906.

PILOT CHART OF THE NORTH ATLANTIC OCEAN, DEC., 1905.—Shows the average meteorological conditions over the North Atlantic during December, the average annual set of ocean currents, lines of equal magnetic variation for every degree for the current year, derelicts, icebergs and field ice, and charts published, cancelled, and corrected.

UNITED STATES.—Geological Map of Miller County, Missouri. Scale, 1:93,750, or 1.47 statute mile to an inch. By Sidney H. Ball and A. F. Smith. Missouri Bureau of Geology and Mines, Jefferson City, Mo.. 1903.

Accompanies the report on "The Geology of Miller County," and gives the geological data in colours. This and several other counties have been surveyed geologically since 1901, and the plan is to survey and report in detail upon all the counties in the State as rapidly as possible.

UNITED STATES.—Geological Map of Moniteau County, Missouri. Scale, nearly 1½ statute mile to an inch. By F. B. Van Horn. Missouri Bureau of Geology and Mines, Jefferson City, Mo., 1905.

UNITED STATES.—Geological Map of Missouri, showing the location of the Principal Stone Quarries. Scale, 18 statute miles to an inch. By H. A. Buehler. Missouri Bureau of Geology and Mines, Jefferson City, Mo., 1904.

Accompanies a *Report* on "The Quarrying Industry of Missouri." The building stones are one of the State's most valuable resources, adding millions each year to her wealth. In this map the geology is reproduced from an earlier map, on which are imposed symbols showing limekilns, limestone, sandstone, granite and other quarries. The *Report* contains other maps showing in greater detail the distribution of quarries in various districts.

CANADA.—Sketch Map showing exploration of Equan and Trout Rivers and West Coast of James Bay. Scale, 50 statute miles to an inch. By D. B. Dowling. Geological Survey of Canada, Ottawa, 1901.

Illustrates explorations to the west of James Bay described in the *Summary Report* for 1901 of the Geological Survey Department.

CANADA.—Sketch Map of Sixty Mile River Gold Fields. Scale, 6 statute miles to an inch. By R. G. McConnell. Geological Survey of Canada, Ottawa, 1901.

Accompanies the report by Mr. McConnell on these gold fields, situated to the west of the Yukon. The points where gold has been discovered on the creeks are indicated.

CANADA.—Map of the Dominion of Canada. Showing Progress of Field Operations by the Geological Survey, 1843-1903, 225 statute miles to an inch. Geological Survey of Canada, Ottawa, 1903.

Illustrates the *Summary Report* of the Geological Survey for 1902. Two tints of red show areas that have been geologically surveyed and partly mapped and those which have been less completely investigated. The areal surveys extend from the international boundary for a considerable distance to the north, the limit being in about 54° N. Lat., in the prairie region of Alberta. The greater part of the Dominion has as yet been surveyed only along the rivers and shores of the lakes, which have been topographically and geologically explored.

Canada.—Geological Map of the Coal Basins of Quilchena Creek, Cold Water River, Coal Gully, and Ten Mile Creek, Nicola Valley, Yale Dist., B. C. Scale, 1 statute mile to an inch. Geological Survey of Canada, Ottawa, 1905.

These coal areas lie to the south of the Canadian Pacific Railroad, and some of them have been mined for several years.

Canada.—Map of Atlin Mining District. Compiled from the latest surveys. Scale, 6 statute miles to an inch. By Brownlee and Lowry. British Columbia Department of Mines, Victoria, 1905.

Shows mineral claims, roads, trails, and many mountain heights in feet, together with survey of the proposed branch of the White Pass R.R. to Windy Arm, where mineral prospects are attracting attention.

Chile.—Canales en el Seno Ultima Esperanza. Scale, 1:30,000, or 0.47 statute mile to an inch. Hydrographic Office, Valparaiso, 1905.

Two charts on one sheet of the White and Kirke Channels in the western part of the Strait of Magellan.

ASIA.

Central Asia.—Karte des Centralen Tian-Schan. Nach Dr. G. Merzbacher und Dr. Max Friederichsen. Scale, 1:2,000,000, or 31.56 statute miles to an inch. *Deutsche Rundschau für Geog. und Stat.*, Vol. XXVIII, No. 1, Vienna, 1905.

Routes and other details of the work of Drs. Merzbacher and Friederichsen are from their original maps, which were noticed in the Bulletin for last January (p. 60) and March (p. 176).

EUROPE.

England.—Inner-London. Scale, 1:80,000, or 1.2 statute miles to an inch. *Deutsche Rundschau für Geog. und Stat.*, No. XXVIII, No. 2, Vienna, 1905.

The scale is large enough to show all the more important features of the inner part of Greater London. Illustrates an Article on "London in der Gegenwart," by Alexander Olinda.

European Turkey.—Hand-Karte der Europäischen Türkei, Bulgarien und Ost-Rumelien. Scale, 1:1,200,000, or 18.93 statute miles to an inch. By A. Klement. Ed. Hölzel, Vienna, 1904. (Price, kr. 3.)

Place-names are very numerous and clearly printed. The spelling is South Slavonic.

L'Annee Cartographique.—Supplément Annuel à Toutes les Publications de Géographie et de Cartographie. Par F. Schrader. Fifteenth year (for 1904). Hachette & Co., Paris, 1905. (Price, frs. 3.)

Three sheets devoted respectively to Africa, America, and Europe. The Africa sheet shows the results of the reconnaissance surveys of Laperrine, Voinot, Thévéniaut and others in the Sahara between Insala and Timbuktu; the route of the projected railroad between Thies and Kayes, which will supplement the steamer route on the Senegal, navigable only a few months in the year. The new frontiers between British and German possessions in Guinea and between French and British possessions in Gambia and in the region between Lake Chad and the Niger; the new political partitions in French West Africa and the mapping of Lake Chad in 1904.

The American sheet shows the results of explorations in upper Argentina and Bolivia in 1903-4; and the Appalachian Mountains from the topographic sheets of the U. S. Geological Survey.

The Asia sheet gives the itineraries of V. Obrutcheff during his expedition in Central Asia, Northern China, and Nan Chan in 1892-94; the progress of the topographic and geodetic surveys in Indo-China; the itineraries of Lieut. Oum in Indo-China and the route surveys of Messrs. Rawling and A. J. G. Hargreaves in western Tibet, reduced from the map in the *Geographical Journal* for last April. The back of each sheet is filled with text explanatory of the maps.

ATLASES.

KLEINER MISSIONS-ATLAS ZUR DARSTELLUNG DES EVANGELISCHEN MISSIONSWERKES NACH SEINEM GEGENWAERTIGEN BESTANDE. VON R. GRUNDEMANN. Third edition. Verlag der Vereinsbuchhandlung. Calw & Stuttgart, 1905. (Price, M. 3.)

This is an admirable, cheap missions-atlas of the entire world. Most of the maps are on a scale of 1:10,000,000, and the map work is excellent in all respects. It is easy to learn from the plates the comparative development of evangelical missions in the various fields, and the information is brought down to date. It is impossible, however, to make a scientific study of mission work without taking into account the enormous participation in it of the Roman Catholic Church. For this reason it is to be regretted that these fine map-plates, ten in number, give so little information about Catholic missions.

MEYERS HAND-ATLAS.—Dritte neuarbeitete und vermehrte Auflage, mit 115 Kartenblättern und 5 Textbeilagen, 40 Lieferungen, including index to place-names. Parts 19-28. Verlag des Bibliographischen Instituts, Leipzig and Vienna, 1905. (Price, 30 pf. a part, or M. 15 for the Atlas bound, including index to place-names; M. 10 not including index.)

These parts complete the maps in this excellent small atlas. The index is yet to come. The maps are cheap in price, but are probably not surpassed in quality by any other maps of similarly small scale. The first 18 parts were noticed in the BULLETIN for October, p. 620.

NORWAY.—Topografisk Kart over kongeriget Norge. Scale, 1:100,000, or 1.5 statute mile to an inch. By the Norwegian Geographical Institute, Christiania. (Price, kr. 0.60 a sheet.) Sheets: Sarpsborg, 10 C.; Ofoten, M. 9; Hugstfjeld, W. 8; Njullas, V. 9; Vestertana, Y. 3.

These are the latest sheets of the superior topographic map of Norway, the chief features of which were briefly described in the BULLETIN of Oct. (p. 619). Col. Per Nissen, Director of the Norwegian Geographical Institute, had an exhaustive article on the mapping of Norway in No. 3 of *Petermanns Mitteilungen,* 1905, which is all the more interesting because of the high quality of map work which that country has attained.

OCEANS.

ATLANTIC.—Campagne Scientifique de la Princesse Alice. *Bull.* No. 46 du Musée Océanographique de Monaco. Monaco, 1905.

Shows the itinerary of the steamer *Princesse Alice* in 1905. Her route extended from the Strait of Gibraltar nearly to 45° W. Long. All soundings are marked in metres. The soundings in the neighbourhood of the Azores complete the bathymetrical map published in 1903.

VARIOUS.

WORLD.—Kolonial und Weltverkehrs-Karte. Scale on the Equator, 1:25,000,000, or 394.5 statute miles to an inch. By Prof. Dr. Th. Cicalek and J. G. Rothaug. G. Freytag & Berndt, Vienna, 1905. (Price, M. 21.)

A large school wall map of the world on the Mercator projection, in which each country and its colonies have a distinct colour. The extent of the colonial possessions of each country is thus made prominent. Other data relate chiefly to the world commercial routes and communications, including railroads, steamship routes, and cables. As ocean currents and drift ice influence communications, the direction of the currents and the limits of drift ice are shown. All interior navigation is depicted, and the latest informaton about colonial boundaries is given. An excellent map for the middle grades in the schools.

ACCESSIONS TO THE LIBRARY.

OCTOBER-DECEMBER, 1905.

AFRICA.

BLYDEN, EDWARD WILMOT.—West Africa before Europe, and other Addresses, delivered in England 1901-1903. London, C. M. Phillips. 1905. 16mo.

BRUUN, DANIEL.—The Cave Dwellers of Southern Tunisia. Translated from the Danish by L. A. E. B. (Illustrations.) London. W. Thacker & Co. 1898. 8vo.

COLQUHOUN, ARCHIBALD R.—The Renascence of South Africa. With map. London, Hurst & Blackett. 1900. 16mo.

GAUTIER, E. F.—Madagascar. Essai de Géographie Physique. Cartes et Planches. Paris, A. Challamel. 1902. 8vo.

GIFFEN, J. KELLY.—The Egyptian Sudan. Illustrated. New York, Fleming H. Revell Co. (1905.) 16mo.

HINDE, SIDNEY LANGFORD AND HINDE, HILDEGARDE.—The Last of the Masai. Illustrations. London, Wm. Heinemann. 1901. sq. 8vo.

HUTCHINSON, G. T.—From the Cape to the Zambesi. Illustrations. London, John Murray. 1905. 8vo.

KELLER, C.—Madagascar, Mauritius and the Other East-African Islands. With 3 Maps and Illustrations. London, Swan Sonnenschein & Co. 1901. 8vo.

MADAN, A. C.—An Outline Dictionary intended as an Aid in the Study of the Languages of the Bantu (African) and other uncivilized Races. London, Henry Frowde. 1905. 12mo.

MOORE, J. E. S.—To the Mountains of the Moon . . . . . Tanganyika Expedition, 1899-1900. Illustrations and Maps. London, Hurst and Blackett. 1901. 8vo.

Paulhiac, H.—Promenades Lointaines: Sahara, Niger, Tombouctou, Touareg. Préface par Hugues Le Roux. (Illustrations et cartes.) Paris, Plon-Nourrit et Cie. [1904?] 16mo.

Renty, E. de.—Les Chemins de Fer Coloniaux en Afrique; 3^{e} Partie: Chemins de Fer dans les Colonies Françaises. (9 Cartes.) Paris, F. R. de Rudeval. 1905. 16mo.

Rogers, A. W.—An Introduction to the Geology of Cape Colony. With chapter on Fossil Reptiles of the Karroo Formation by R. Broom. Illustrations and coloured Map. London, Longmans, Green & Co. 1905. 8vo.

Samassa, Paul.—Des neue Südafrika. Berlin, C. A. Schwetschke und Sohn. 1905. 8vo.

AMERICA.

Bacon, Edgar Mayhew.—The Hudson River: From Ocean to Source. With 100 Illustrations and Sectional Map. New York, G. P. Putnam's Sons. 1903. 8vo.

Brown, G. M.—Ponce de Leon Land. (With Portrait.) 2nd Edition. St. Augustine, Fla. 1895. pr., 8vo.

Butterfield, Consul Willshire.—History of Brulé's Discoveries and Explorations 1610-1626. (Illustrations and 2 maps.) Cleveland, O. Helman Taylor Co. 1898. 8vo. (Western Reserve Historical Society.)

Dawson, S. E.—Hand-Book for the Dominion of Canada. Prepared for the Meeting of the British Association for the Advancement of Science, Montreal. 1884. 2nd Edition. (4 maps.) Montreal. Dawson Bros. 1888. 16mo. [*Gift from the Author.*]

Deckert, Emil.—Nordamerika. 2te Auflage. Abbild., Kartenbeilagen, Tafeln. Leipzig u. Wien, Bibliographisches Institut. 1904. 8vo.

Fraser, John Foster.—Canada As It Is. With Plates. London, et al., Cassell & Co. 1905. 16mo.

Hamy, E. T.—Lettres américaines d'Alexandre de Humboldt (1798-1807). Précédées d'une Notice de J.-C. Delamétherie et suivies d'un choix de documents en partie inédits. Paris, E. Guilmoto. (1905.) 8vo.

Hine, C. Vickerstaff.—On the Indian River. 2 maps, and illustrations. Chicago, C. H. Sergel & Co. 1891. 8vo.

Ley, John C.—Fifty-two Years in Florida. Nashville, Tenn., Barbee & Smith. 1899. 16mo.

Maldonado, Juan Alvarez.—Relación de la Jornada y Descubrimiento del Rio Manu (Hoy Madre de Dios) en 1567. Publicala Luis Ulloa. [Map.] Sevilla, C. Salas. 1899. pr. 8vo.

Martinez, Alberto B.—Baedeker de la República Argentina. Con Mapas y Planos, ... y numerosos Fotograbados. 2^{a} Edición. Buenos Aires, J. Peuser, 1904. 16mo. [*Gift from the Author.*]

Mexico: Its Social Evolution.—(By Thirteen Authors.) Edited by Justus Sierra and James Ballescá. Translated into English by G. Sentiñón. Illustrated. Mexico, J. Ballescá & Co. 1900-1904. 2 vols. in 3. folio. [*Gift from the Mexican Consulate General, N. Y. City.*]

Norton, Charles Ledyard.—A Handbook of Florida. 49 maps and plans. New York, Longmans, Green & Co. 1891. 16mo.

OUTRAM, JAMES.—In the Heart of the Canadian Rockies. With maps and illustrations. New York, The Macmillan Co. 1905. 8vo.

PULLEN-BURRY, B.—Ethiopia in Exile; Jamaica Revisited. London, T. Fisher Unwin. 1905. 8vo.

RIO, MANUEL E., Y ACHAVAL, LUIS.—Geografía de la Provincia de Córdoba. Publicación Oficial. Buenos Aires. Compañía Sud-Americana de Billetes de Banco. 1904-1905. 2 vols. 8vo., [and Atlas of Plates and Maps, folio.]

SCHAFER, JOSEPH.—History of the Pacific Northwest. Maps and Illustrations. New York, The Macmillan Co. 1905. 16mo.

THWAITES, REUBEN GOLD. *Editor.* Early Western Travels: 1748-1846. Vol. III, Travels West of the Alleghanies by André Michaux, F. A. Michaux, T. M. Harris; Vol. XVIII, Personal Narrative of James O. Pattie of Kentucky, ... during journeyings of six years, &c. Cleveland, O., Arthur H. Clark Co. 1905. 8vo.

WALKER, H. DE R.—The West Indies and the Empire. Study and Travel in the Winter of 1900-1901. With map. London, T. Fisher Unwin. 1901. 8vo.

WIBORG, FRANK.—A Commercial Traveller in South America. (Maps, &c.) New York, McClure, Phillips & Co. 1905. 16mo.

WIENER, CHARLES.—Chili et Chiliens. [Illustrations.] Paris, Léopold Cerf. 1888. 8vo.

ANTARCTIC.

ARMITAGE, ALBERT B.—Two Years in the Antarctic. Being a Narrative of the British National Antarctic Expedition. Illustrations and Map. London, Edward Arnold. 1905. 8vo.

BRUCE, WILLIAM S.; PIRIE, J. H. HARVEY; MOSSMAN, ROBERT C. AND BROWN, R. N. RUDMOSE.—Some Results of the Scottish National Antarctic Expedition. (2 maps, and illustrations.) *Corrected reprint from the Scottish Geographical Magazine for August 1905.* [*Gift from the Authors.*]

SCOTT, ROBERT F.—The Voyage of the 'Discovery.' Illustrations and Maps. New York, Charles Scribner's Sons. 1905. 2 vols. 8vo.

ASIA.

ANDRADE, ANTOINE D'.—Relation de la Nouvelle Descouverte du grand Catay, ou bien du Royaume de Tibet. A Paris, Sebastien Chappelet. 1627. 16mo.

ATKINSON, FRED. W.—The Philippine Islands. [Illustrated.] Boston, Ginn & Co. (1905) 8vo.

BAEDEKER, KARL.—Konstantinopel und das Westliche Kleinasien. 9 Karten, 29 Plänen und 5 Grundrissen. Leipzig, 1905. 16mo.

CLEMENT, ERNEST W.—Christianity in Modern Japan. Map, &c. Philadelphia, American Baptist Publishing Society. 1905. 8vo.

CROSBY, OSCAR TERRY.—Tibet and Turkestan. Illustrated. New York and London. G. P. Putnam's Sons. 1905. 8vo.

DEVÉRIA, G.—La Frontière Sino-Annamite. Description Géographique et Ethnographique d'après des Documents Officiels Chinois traduits pour la première fois. (Cartes, &c.) Paris, Ernest Leroux. 1886. 8vo.

Garnier, Francis.—De Paris au Tibet. Notes de Voyage. 2e Edition. Gravures et carte. Paris, Hachette et Cie. 1887. 16mo.

Genschow, A.—Unter Chinesen und Tibetanern. Abbild. . . . und . . . 5 Karten, &c. Rostock i. M., C. J. E. Volckmann (Volckmann & Wette), 1905.

Goeje, M. J. de.—Mémoire sur les Migrations des Tsiganes à travers l'Asie. *Mémoires d'Histoire et de Géographie Orientales, No. 3.* Leide, E. J. Brill. 1903. pr. 16mo.

Gonnaud, Pierre.—La Colonisation Hollandaise à Java. Ses Antécédents, ses Caractères distinctifs. Thèse pour le Doctorat présentée à la Faculté des Lettres de l'Université de Paris. Paris, Augustin Challamel. 1905. 8vo.

Hedin, Sven.—Scientific Results of a Journey in Central Asia, 1899-1902. *Vol. II,* Lop-Nor (Maps and Plates.) *Vol. V, Part I, a.:* Meteorologie von Dr. Nils Ekholm, 1, Die Beobachtungen, 1894-97 und 1899-1902. *Maps, II.* Stockholm, General Staff of the Swedish Army. (1905). 4to, and Maps, folio.

Lepesqueur, Parfait-Charles.—La France et le Siam. *Extrait No. 21, du Bulletin de la Société Académique Indo-Chinoise de France, 2´ Série, T. IV.* Paris, Au Siège de la Société. 1897. pr. 8vo. [*Gift from the Author.*]

Pallegoix, Mgr.—Description du Royaume Thai ou Siam. Carte et Gravures. Paris, Mission de Siam. 1854. 2 tomes, 12mo.

Philippine Islands, 1493-1898.—Explorations of Early Navigators, &c., as related in contemporaneous Books and MSS. Translated from the Originals. Edited, &c. by Emma Helen Blair and James Alexander Robertson. With maps, &c. Vols. XXX-XXXII. Cleveland, A. H. Clark Co. 1905. 8vo.

AUSTRALIA.

(Australia, Western.) Calvert Scientific Exploring Expedition, 1896. Compiled by J. G. Hill. [With 2 maps.] London, George Philip & Son. 1905. sq. 16mo.

Australia, Western. Journal of the Calvert Scientific Exploring Expedition, 1896-7. *Equipped at the request and expense of Albert F. Calvert, . . . London, for the purpose of Exploring the remaining blanks of Australia.* [With two maps.] Perth, By Authority . . . Gov't Print. [1905.] *Parliamentary Blue Book No. 46.*

EUROPE.

Annandale, Nelson.—The Faroes and Iceland: Studies in Island Life. With illustrations, and Appendix on the Celtic Pony by F. H. A. Marshall. Oxford, The Clarendon Press. 1905. 8vo.

Balkanhalbinsel, Zur Kunde der. Reisen und Beobachtungen. Herausgegeben von Carl Patsch. *Heft I:* Eine Reise durch die Hochländergaue Oberalbaniens. Von Karl Steinmetz. *Heft II:* Aus Bosniens Letzter Türkenzeit. Von Josef Koetschet. Veröffentlicht von Georg Grassl. *Heft III:* Ein Vorstosz in die Nordalbanischen Alpen. Von Karl Steinmetz. Abbildungen und Karten. Wien und Leipzig, A. Hartleben. 1904-1905. pr. 8vo.

Belgique, La. Institutions, Industrie, Commerce. (Cartes et Gravures.) Bruxelles, J. Goemaere, Imprimeur du Roi. 1905. 8vo. [*Gift from the Ministre de l'Industrie et du Travail, Bruxelles.*]

Chaix, Émile.—Érosion Torrentielle Post-Glacière dans quelques vallées. (Avec six planches hors texte.) Genève, R. Burkhardt. 1902. *Extrait du*

Globe, journal géographique, Société de Géographie de Genève, Tome XLI (1902), Mémoires. [*Gift from the Author.*]

CHAIX, ÉMILE.—Le pont des Oulles. Phénomène d'erosion par les eaux courantes (Bellegarde, Ain). [With 7 illustrations.] *Extrait, La Géographie, Bulletin de la Société de Géographie, Tome VIII, No. 6, décembre, 1903. Paris.* pr. 8vo. [*Gift from the Author.*]

COOK, THEODORE ANDREA.—Old Provence. (Illustrations.) New York, Charles Scribner's Sons. 1905. 2 vols. 8vo.

GILLIODTS-VAN-SEVEREN, L.—Cartulaire de l'Ancienne Estaple de Bruges: Recueil de documents concernant le commerce intérieur et maritime . . . . de cette ville. Tome III. Bruges, Louis de Plancke. 1905. 8vo. [*Gift from the Author.*]

HOARE, RICHARD COLT.—Tour through the Island of Elba. Illustrated with Views drawn from Nature by [the Author] and John Smith. London, John Murray [and others]. 1814. 4to.

HULL, EDWARD.—The Coal-Fields of Great Britain: History, Structure and Resources, &c. Maps and Illustrations. 5th Edition, revised. London, Hugh Rees. 1905. 8vo.

HUTCHINSON, J. T. AND COBHAM, C. D.—Handbook of Cyprus. With Frontispiece and two Maps. London, Edward Stanford. 1905. 16mo.

JOUSSET, P.—L'Italie Illustrée. 14 Cartes et Plans en couleurs, 9 cartes en noir, 12 Planches, 784 Reproductions photographiques. Paris, Librairie Larousse. s. a. 4to.

REGELL, P.—Das Riesen- und Isergebirge. Mit 89 Abbildungen und einer farbigen Karte. Bielefeld und Leipzig, Velhagen & Klasing. 1905. 8vo. *Land und Leute, XX.*

SMITH, GOLDWIN.—Irish History and the Irish Question. New York, McClure, Phillips & Co., 1905. 8vo.

WYON, REGINALD.—The Balkans from Within. (Illustrations and two maps.) London, James Finch. 1904. 8vo.

WYON, REGINALD AND PRANCE, GERALD.—The Land of the Black Mountain: Adventures of Two Englishmen in Montenegro. Illustrations. London, Methuen & Co. 1903. 16mo.

GEOGRAPHY.

BAUR, FRANZ.—Mathematische Geographie. Mit 22 den Text erläuternden Figuren. *Miniatur-Bibliothek.* Leipzig, Albert Otto Paul. (1905) 32mo.

BULLETIN DE GÉOGRAPHIE HISTORIQUE ET DESCRIPTIVE. Année 1904. Paris, Ernest Leroux. 1904. 8vo.

CHAIX, ÉMILE.—Notes d'Analyse Géographique: conditions qui déterminent la valeur économique d'un pays. Genève, Philippe Dürr. 1906. 16mo. [*Two copies, gift from the Author.*]

CONGRESS, GEOGRAPHIC, FIFTH ITALIAN. Atti del V. Congresso Geographico Italiano, tenuto in Napoli dal 6 a 11 Aprile 1904. Vol. I: Notizie, Rendiconti e Conferenze; Vol. II: Temi, Comunicazioni e Memorie. Napoli, A. Tocco & Salvietti. 1905. 8vo.

CONGRESS, GEOGRAPHIC, EIGHTH INTERNATIONAL, held in the United States, 1904. Report. Washington, Gov't Printing Office. 1905. 8vo.

Gannett, Henry, Garrison, C. L., and Houston, E. J.—Commercial Geography. [Illustrations and Maps.] New York, American Book Co. (1905.) 16mo. [*Gift, from Henry Gannett.*]

Hassinger, Hugo.—Geomorphologische Studien aus dem Inneralpinen Wiener Becken und Seinem Randgebirge. Mit 11 Textabbildungen u. einer Tafel. Leipzig, B. G. Teubner. 1905. 8vo. *Geographische Abhandlungen, Herausgegeben von Dr. Albrecht Penck, Band VIII, Heft III.*

Heilprin, Angelo and Heilprin, Louis.—Complete Pronouncing Gazetteer or Geographical Dictionary of the World. Philadelphia and London. J. B. Lippincott Co. 1906. 4to.

Herbertson, A. J.—The Junior Geography. (Illustrated.) *The Oxford Geographies, Vol. II.* Oxford, Clarendon Press. 1905. 16mo.

Marcuse, Adolf.—Handbuch der Geographischen Ortsbestimmung für Geographen und Forschungsreisende. Abbild. und 2 Sternkarten. Braunschweig, Friedrich Vieweg und Sohn. 1905. 8vo.

Plessis de Grenedan, J. du.—Géographie Agricole de la France et du Monde. Figures et cartes. Paris, Masson et Cie. 1903. 8vo.

Wollemann, A.—Bedeutung und Aussprache der wichtigsten schulgeographischen Namen. Braunschweig, Wilhelm Scholz. 1905. pr., 8vo.

MAPS AND ATLASES.

Africa, Stanford's New Orographical Map. *Scale* 120 miles = 1 inch. *Size* [4 sheets joined] 49 x 60 inches. London, Edward Stanford. 1905.

[Asia Minor] Karte von Kleinasien in 24 Blatt. 1:400,000. Richard Kiepert. Berlin, D. Reimer (Ernst Vohsen.) [In course of publication. Sheets C I, Smyrna, and D II, Adalia, 1905, received.]

Atlas. Grundemann, R.—Kleiner Missions-Atlas . . . . In zehn Karten. Calw und Stuttgart, Vereinsbuchhandlung. 1905. 4to.

Atlas. Hickmann, A. L.—Geographisch-Statistischer Universal-Taschen-Atlas. Wien und Leipzig. G. Freytag & Berndt. (1905.) 16mo.

Australia, Western. Three maps, as follows: [1.] 1901. *Scale* 70 miles = 1 inch. *Size* 15 x 22 inches; [2.] 1903. *Scale* 70 miles = 1 inch. *Size* 15 x 22 inches. With Inset map showing Timber Areas; [3.] 1903. *Scale* 50 miles = 1 inch. *Size* 22 x 32 inches. Perth, Department of Lands and Surveys. [*Gift from H. F. Johnston, Surveyor General.*]

Australia, Western. Twelve maps, gift from the Government Geologist, Perth, W. A.:

Collie Coal Field, Geological Map. By A. Gibb Maitland, Gov't Geologist. 1898. *Scale* 40 chains = 1 inch. *Size* 36 x 25 inches.

Coolgardie, Geological Map. Geological Lines by Torrington, Blatchford & E. L. Allhusen. 1898. *Scale* 10 chains = 1 inch. 4 sheets, each 25½ x 36 inches.

Coolgardie Gold Field, East Boulder Belt, Geological Map. By A. Gibb Maitland, Gov't Geologist and W. D. Campbell, Ass't. 1903. *Scale* 4 chains = 1 inch. 2 sheets, each 37 x 27 inches. With accompanying sheet showing Vertical Sections.

Coolgardie Gold Field, East. Boulder Belt Mining Map. Based on Surveys by W. D. Campbell and the late S. J. Becher. 1900. *Scale* 4 chains = 1 inch. 2 sheets, each 37 x 27 inches.

Coolgardie Gold Field, North. Menzies, Topographical Map. By W. D. Campbell. 1899. *Scale* 20 chains = 1 inch. 2 sheets, each 31 x 22 inches.

Country between Cue, Peak Hill and Menzies, Geological Sketch Map. [Undated.] *Scale* 23 miles = 1 inch. *Size* 11½ x 18 inches.

Kalgoorlie, Geological Map. By A. Gibb Maitland, Gov't Geologist and W. D. Campbell, Ass't. 1902. *Scale* 10 chains = 1 inch. 6 sheets, each 27 x 37 inches.

Kalgoorlie. Topographical Map based on Surveys by W. D. Campbell and the late S. J. Becher. 1900. *Scale* 10 chains = 1 inch. 4 sheets, each 27 x 37 inches.

Kimberley District. Geological Map to accompany Report of Edward T. Hardman . . . . 1883. Drawn by Chas. Youle Dean, Survey Office, Perth. *Scale* 6½ miles = 1 inch. *Size* 49 x 28½ inches.

Kimberley District. Geological Map to accompany Report of E. T. Hardman, 1884. [Same title, scale and size as the above map.]

Northampton, Geological Map. By A. Gibb Maitland, Gov't Geologist. 1898. *Scale* 20 chains = 1 inch. 2 sheets, each 38 x 25 inches.

North Lead Kanowna. Geological Map by F. Blatchford. Showing bores put down 1900-'01. *Scale* 8 chains = 1 inch. Size 20 x 13½ inches.

[AUSTRIA.] Schulwandkarte des Erzherzogtums Österreich unter der Enns. Bearbeitet von Joh. Georg Rothaug. Für Mittelschulen bearbeitet von Prof. Dr. Friedrich Umlauft. *Scale* 1:150,000. *Size* [4 sheets, each] 34 x 25 inches. Wien, G. Freytag & Berndt. [1904?]

BERLIN [AND ENVIRONS.] Sheets 268, 269, 293 & 294 of the Karte des Deutschen Reichs. *Scale* 1:100,000. *Size* [of each sheet] 11¼ x 14 inches. Berlin, Königl. Preuss. Generalstabe. 1897.

BUDAPEST AND ENVIRONS. Sheets 15 XX. and 16 XX. of the Spezialkarte der österreichisch-ungarischen Monarchie. *Scale* 1:75,000. *Size* [each sheet] 20¾ x 15¼ inches. Wien, k. u. k. Militärgeograph. Institutes. 1884-1902.

CALCUTTA. Sheet 121 of The Indian Atlas, showing the City. *Scale* 4 miles = 1 inch. *Size* 40 x 26½ inches. (Calcutta), Survey of India. 1903.

[CANADA] LAKE TEMAGAMI, Temagami Forest Reserve, District of Nipissing, Plan of Islands in. *Scale* 40 chains = 1 inch. *Size* [2 sheets joined] 46 x 59 inches. Toronto, Minister of Lands and Mines, 1905. With 19 pp. 12mo book, List of Islands in Lake Temagami. [*Gift.*]

CANADA. MANITOBA, SASKATCHEWAN AND ALBERTA. Special Edition, showing even-numbered Sections finally disposed of. Corrected to May 1, 1905. [Ottawa] Dep't of the Interior. *Scale* 12½ miles to 1 inch. *Size* [3 sheets joined] 78½ x 37 inches. [*Gift, from James White, Geographer, Ottawa.*]

CANADA. NEW BRUNSWICK, St. John Sheet. [Being Sheet 13 of the Standard Topographical Map.] [Ottawa], Dep't. of the Interior, 1905. *Scale* 7.89 miles = 1 inch. *Size* 19 x 30 inches. [*Gift from James White, Geographer, Ottawa.*]

CANADA. SASKATCHEWAN AND ALBERTA. Three maps showing Electoral Districts, 1905: (1) The Two Provinces. *Scale* 35 miles = 1 inch. *Size* 24¼ x 24 inches; (2) Southern Saskatchewan. *Scale* 12 miles = 1 inch. *Size* 32¾ x 37 inches; (3) Southern Alberta. *Scale* 12 miles = 1 inch. *Size* 32¾ x 37 inches. [Ottawa], Dep't of the Interior. [*Gift from James White, Geographer.*]

CHILE. Three Charts of the Coast published by the Oficina Hidrográfica, 1905:

Magallanes: Puertos en el Golfo Xaultegua: Estuario Guzman; Puerto Bobillier. *Scale* 1:20,000. *Size* 15 x 9 inches. (112)

Seno Última Esperanza. Canal Señoret i Estero Eberhardt. *Scale* 1:30,000. Size 17⅛ x 22¼ inches. (Provisional 122)

Canales en El Seno Última Esperanza. Canal White; Canal Kirke. *Scale* 1:30,000. *Size* 13½ x 18½ inches. (Provisional 123)

Also Sheet showing Conventional Signs and Abbreviations used upon the Charts published by the Oficina Hidrográfica. 1905. *Size* 16 x 12½ inches.

CHINA. Prepared for the China Inland Mission. (After Bretschneider, with Additions.) 1905. London, Edw. Stanford. *Scale* 50 miles = 1 inch. *Size* [4 sheets joined] 44 x 38 inches. [*Gift from the China Inland Mission.*]

[CHRISTIANIA AND ENVIRONS.] Sheet 14 D of the Topografisk kart over Kongeriget Norge. *Scale* 1:100,000. *Size* 19 x 14¼ inches. Kristiania, Norges geografiske opmaaling. 1900.

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BOOK NOTICES.

La Montagne Pelée et ses Éruptions, par A. Lacroix, Membre de l'Institut, etc. 4to. pp. xxii, 662, pl. 31, text figs. 238. Masson & Cie., Paris, 1904.

This magnificent volume comprises the results of what is probably the most painstaking and thorough investigation of a single series of volcanic eruptions ever undertaken, and is the work of a master of his science. Immediately after the occurrence of the great eruption of Mt. Pelé, May 8, 1902, by which St. Pierre, Martinique, was laid waste and its inhabitants destroyed, the author was sent to the island by the Ministers of Public Instruction and The Colonies as the head of two successive Commissions* chosen by the Paris Academy of Sciences for the purpose of studying all the phenomena attending the eruptions. Lacroix himself devoted seven months to residence in Martinique, establishing one fully-equipped observatory and a second subordinate observing station, and organizing a Commission which still keeps constant watch upon the volcano. The observatory of Morne des Cadets was built in October, 1903, and was provided with two seismographs, and ample apparatus for meteorologic and photographic work and for making angular observations for determinations of altitude.

The report is divided into three sections: The physics of the globe as illustrated by the phenomena observed by the author on Martinique, Saint Vincent, and Guadeloupe; a chemical and mineralogical study of the products of the eruptions of 1902-1903, supplemented by a comparative study of the older rocks of Martinique and the rocks of other islands of the Lesser Antilles; a study of the minerals and rocks produced during the conflagration of St. Pierre.

The first section fills more than three-fourths of the book with a wealth of observations, fortified with profuse and excellent illustrations, which must ever be the storehouse of data regarding this remarkable series of eruptions. The list of topics considered, as given in the table of contents, is an indication of the breadth of view entertained by the author and the thoroughness with which he has treated every phase of a great subject. The photographs used for the illustrations were taken, almost without exception, by the author himself or by Mme. Lacroix, who accompanied him on both his expeditions to the islands.

Lacroix considers the most important features of the eruptions to have been the formation of the vast dome and spine which filled the old crater of Mt. Pelé and rose far above the former summit of the mountain, and the frequently-recurring exploding clouds of dust-laden steam, his "nuées ardentes."

The beginning of the rise of the "spine" above the top of the cone of eruption in October, 1902, was witnessed by Lacroix, and he watched its growth and variation constantly from that time till about the middle of March, 1903, when it had nearly attained its maximum development of 1,617 meters (5,304 feet) above tide. He was the first to recognize the fact that the new cone was not primarily of fragmental constitution, but that it was formed mainly of practically solid rock. He holds that the molten but highly viscous lava on reaching the surface of the earth welled out of the conduit of the crater in cumulous form and quickly became covered with a solid crust, which protected the pasty interior from a too rapid loss of heat and complete solidification. The crust became fissured through progressive cooling and consequent contraction and through continued pressure from within. This permitted the further exudation of pasty lava and the construction of a homogeneous rock mass with abrupt, deeply-fissured exterior. The extrusion of the great spine is compared to the production of a metal rod through a draw-plate, and attention is called to the repeated formation of many similar but more ephemeral needles during seasons of marked activity. He says that these extrusions were caused by the localization of the eruptive force within limited areas and the consequent rupture of the new crust. The formation of this dome and its surrounding spine is declared to be the most remarkable feature of any recorded volcanic eruption, and Lacroix holds that it explains the origin of many abrupt rock masses in regions of extinct volcanic activity which have been described as the cores or "plugs" of dissected volcanoes.

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* The members of the first commission sent out were: A. Lacroix, Rollet de l'Isle, and J. Giraud. The second commission consisted of Professor Lacroix alone, but he was joined in March, 1903, by M. Giraud, who remained in charge of the work after Lacroix's return to France.

The chief assistants at the observatories have been Capt. Perney, Ensign Le Cerf, and Adjutant Guinoiseau.

The "nuées ardentes" were the destructive agent of the volcano, and they furnished geeologists with another novel feature of vulcanism. The theory advanced to account for them considers the clouds as the result of explosions from the flanks of the cone at Pelé and from the bottom of an open crater at Saint Vincent. In the case of feeble eruptions gravity exercised a predominating influence on the advance of the clouds down the mountain side, but with the heavy paroxysms the greater rapidity of motion was due to the initial accumulated force of projection combined with gravity acting in the same direction.

Among other important new ideas added to our knowledge of vulcanism by these eruptions may be mentioned the occurrence in the cone of a rock with a matrix rich in crystals of quartz formed during periods of very slow extrusion; the establishment of relationships among all the rocks of the Lesser Antilles, showing that they form a true petrographic province, the new rocks of Saint Vincent, for example, having their counterparts in the older eruptions of Martinique; the formation in the enormously thick ash-beds of secondary fumaroles—*i. e.*, fumaroles without connection with a deep-seated source of heat; the transportation by the "nuées ardentes" of blocks of lava of enormous size along the sides of the mountain without reference to the topography thereof.

Lacroix concludes that sometimes the conditions under which an eruption occurs have more effect than the chemical composition of the magma upon the accompanying phenomena. The eruptions of Saint Vincent, where the lava is the more basic, were purely explosive, while those of the more acid lava at Pelé were not simply explosive but they also resulted in the formation of a great cone out of fresh lava which was too viscous when extruded to make a stream and flow down the mountain side.

Lacroix lays stress upon the fact that the effects of heat observed in the ruins of the city of St. Pierre were due, not to the temperature of the swiftly-passing cloud, but to the general conflagration started by that cloud. He says that the burning of St. Pierre would not have possessed a factor of value to the history of eruptive rocks if the city had not been constructed of volcanic materials. As it was, however, many interesting facts were brought out by the study of the walls and the objects which were more or less melted in the burning buildings, producing secondary "lavas" and products of re-crystallization.

The final estimate of the number of persons killed by the eruptions or who died of their wounds is about 28,000 as a maximum for St. Pierre and vicinity May 8, and 1,000 more for Morne Rouge and Ajoupa-Bouillon August 30, 1902. Lacroix discusses all the causes of death which have been suggested, and concludes that the majority of fatalities were due to asphyxiation consequent upon the inhalation of hot dust, steam, and hot air. He does not consider it probable that poisonous sulphur or carbon gases played any important rôle in the destruction of life, and he likewise rejects lightning as having been a great destructive agent at St. Pierre.

Lacroix accepts as true the report of the survival of at least two persons, the famous prisoner and a shoemaker, who were in the city during the eruption. He also cites the cases of persons in houses upon the bluffs overlooking the city and of those upon the ships who survived the eruption, and contends that many lives would have been saved had the houses of St. Pierre been so constructed as to allow of complete closing or had there been cellars beneath them to which the occupants might have resorted. This conclusion is confirmed by reference to the salvation of many persons in heavy stone buildings within the zone of greatest devastation at St. Vincent.

Lacroix recognizes the necessity of an initial explosion to assist the action of gravitation in the advance of the "nuées ardentes" from the crater, and he considers the explosive expanding power of steam suddenly liberated at the probable issuing temperature of 1,200°C. as being ample to account for all the observed phenomena assigned to the action of the destructive blast. He says: "For my part, I do not understand this blast unless there were an initial projection, the direction of which was determined by that of the opening in the flank of the growing dome opposite the V-shaped breach. The force of this initial projection was sufficient to prevent the exploding cloud from being restricted to a southwesterly direction only through the great cleft."

The lava of the eruption is a hypersthene-andesite, which occurs in four types distinguished from one another by their structure and their mineralogical composition. The chemical composition remains the same throughout. The classification into types depends upon the character of the ground-mass. Type I is solidly glassy (obsidian); type II is porously glassy (pumiceous); types III and IV have a cryptocrystalline base, III being non-quartziferous, and IV being rich in quartz. The phenocrysts (porphyritic crystals) of the lava are, in descending order of importance, plagioclase, feldspars, hypersthene, titanomagnetite, olivine, augite, hornblende, ilmenite, and apatite.

The main portion of the dome is considered to be composed of lava of types I, II, and III, while the spine probably consisted of type IV. The "nuées ardentes" of November, 1902, occurring after some weeks of comparative quiet, distributed material of type III, but the continually increasing activity of the succeeding weeks and months discharged dust and lapilli of type I. The eruptions of July 9, August 30, and November 28, 1902, were characterized by the ejection of vast quantities of angular pumice of type II, but it is not to be supposed that any of the great eruptions furnished lava of only one type. The breadcrust bombs which were thrown out in a thoroughly pasty condition show andesite of type I in the crust and pumice (type II) in the interior. The angular bombs which were ejected in a semi-solid condition show a tendency toward type III.

E. O. H.

Lehrbuch der Meteorologie. Von Dr. Julius Hann, Professor an der Universität in Wien. Zweite, neubearbeitete Auflage. 8vo. Leipzig, 1905. Pp. xi + 642.

The first edition of Hann's master-work on meteorology appeared in 1901. In four years, so rapid has been the advance along many lines, that to the second edition just published many additions have been made, chiefly as regards the results obtained by means of kites and balloons, and during the International Cloud Year. What Hann's *Handbuch der Klimatologie* is to climatology, his *Lehrbuch der Meteorologie* is to meteorology; authoritative; indispensable; the standard book on the subject. More need not be said. Teachers and students of climatology will find much in the *Lehrbuch* which can be used to supplement the data and the discussions in the *Klimatologie*. With these two books—fitting companion-volumes by the acknowledged master of the science of meteorology in all its bearings—any teacher is admirably equipped for giving instruction in meteorology or climatology. As a bibliography alone, either volume is worth more than it costs. R. DeC. W.

Le Sahara, le Soudan, et les Chemins de Fer Transsahariens. Par Paul Leroy-Beaulieu, Membre de l'Institut, Professeur au Collège de France, Directeur de l'Économiste Français. Paris, Guillaumin et Cie., 1904. (Pr., 8 fr.)

In the first place, this book is a plea for the construction of a railroad, or railroads, across the Sahara, a great trunk line, from Algiers to Lake Chad, and a western line connecting Algiers with Senegambia. The discussion of this project naturally includes much that is only of a technical or national interest; but these problems are illustrated everywhere by the description of geographic conditions selected from the writings of the great authors on Africa, from Barth to the present, so that the reader incidentally gains quite a considerable amount of actual geographic information about the country. While not claiming to be more than a compilation in this respect, the book has the decided merit of being one of the best works of this kind, by bringing before a wider public, in a systematic, well-rounded, scholarly arrangement, selections from the best literature on the subject which it would be difficult for the average reader to procure in its original form.

From the reports of the explorers, from Governmental documents, and from his own observations in connection with colonial work in French Africa, the author has gained the conviction that "the pretended absolute unproductiveness of the Sahara is a legend which it is easy and necessary to destroy," and he claims, not without reason, that his book is likely to give a "complete rehabilitation of the Sahara," whose "enormous possibilities" promise abundant returns of the capital and energy spent on it.

Only one-tenth of its area is actually the desert of moving sands which it is generally believed to be, and the causes of its desolation are, not its barrenness, but the lack of irrigation and of safety.

The climate is healthy and stimulating. The available water, if properly taken care of, would be sufficient to supply engine tanks and the needs of railroad officials all along the proposed line, and traces of permanent settlements are found everywhere: abandoned, not for lack of water, but in consequence of the devastations of the marauding desert tribes. With a proper care of the water supply, by irrigation plants, boring of artesian wells, and sanitation of the existing wells, whose neglected condition alone makes them unhealthful, and with public safety established under a firm Colonial Government, the so-called desert could easily be brought up to the condition of the Crau and Causses regions in France, and support a population of ten millions.

Under such conditions the building of a railroad would not only be feasible, but even prove a good investment, and more and more so in proportion as it contributed in its turn to the further development of the country. It would even have better chances at the start than the transcontinental railroads of America and Asia, in so much as railroads following the meridian as connections of zones of different products are of greater importance than those running along parallels. A railroad which would create a direct route of transportation for the products of the Sudan—which would, so to speak, bring the tropics within six days from London, Paris, or Berlin—would be of greater geographical importance than any other trunk line previously constructed.

Nor would the character of the country make its construction a great financial risk. Apart from the one-tenth of actually sandy desert, the ground is firm and solid. In its barest form it is the "hamada," a rocky plateau formation of partly cretaceous, partly Devonian, origin, with little or no soil or water. Where it is intersected by valleys the country is called "Sebka" (= net) by the Arabs, and the mesas left by erosion on the plateau or in the valleys are called "gour" or "mehasser," respectively. The plateau ends with a steep bluff called "kef" or, where it is large enough to resemble a mountain chain, "djebel."

The lower regions, called "nebka" (= moist depression), often have a sandy subsoil, but, owing to the moisture, it is firm and fit for vegetation, so that these regions, too, are perfectly practicable.

Even in the region of the "erg," the real sand dunes, the situation is not hopeless. For not only are they localized, so that they can easily be avoided; they are also separated by longitudinal valleys, "gassis," where the ground is firm sand, with or without gravel ("reg"), and perfectly safe for building purposes.

The grades are gentle everywhere, the highest location of the watershed being about 4,000 feet, so that, everything considered, the technical difficulties of the road would be even less than those of the American or the Canadian Pacific.

A beginning has already been made by the "Société des Phosphates et du Chemin de Fer de Gafsa;" a line of 245 kilometers from the port of Sfax to the phosphate mines of Metlaoui; a line which is operated without the slightest difficulty and pays large dividends. The main obstacle to constructions on a larger scale is the slowness of Government action, impeded by Parliamentary and bureaucratic routine, and the author hopes that private initiative may step in to accomplish the great work.

There is no doubt that, aside from its mere geographical importance and its influence on the consolidation of French colonies in Africa and the strengthening of French influence on that continent in general, such a railroad would be a matter of international interest. The author is certainly right in saying that, with such a railroad at the command of France, matters might have taken a very different turn at Fashoda. For the sake of the peaceful commerce of the nations, as well as of a safe equilibrium of European influence in Northern Africa, it is to be hoped that the author's plea may not have been in vain.

M. K. G.

BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY.

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MEETING OF THE ASSOCIATION OF AMERICAN GEOGRAPHERS.

The second annual meeting of the Association of American Geographers was held in this city on December 26 and 27, 1905. The facilities of the house of the American Geographical Society were placed at the service of the Association. About forty members and invited speakers participated in the four sessions. The occasion was much enjoyed both as a social reunion and as offering an interesting programme in which the several phases of geography—particularly the organic, physiographic, and educational—were well represented. The meeting was under the presidency of Professor W. M. Davis, of Harvard University.

The American Geographical Society served luncheon to the members on both days of the meeting. The annual dinner took place at the Hotel Endicott on the evening of December 26.

Many of the papers were illustrated by lantern views. The following papers, unless otherwise indicated, were read by their authors:

W. M. Davis (President's Address). An Inductive Study of the Content of Geography.

A. H. Brooks. The Influence of Geography on the Exploration and Settlement of Alaska (illustrated).

J. Walter Fewkes. The Sun's Influence on the Orientation of Hopi Pueblos (illustrated with diagrams).

Martha Krug Genthe. Valley Towns of Connecticut. (This paper will be printed in full hereafter in the BULLETIN.)

E. O. Hovey. Geographical Notes on the Western Sierra Madre of Chihuahua (illustrated).

A. P. Brigham. Lake Loen (Norway) Landslip of January, 1905 (illustrated).

Emory R. Johnson. Political Geography as a University Subject.

Cyrus C. Adams. Map Making in the United States.

Cleveland Abbe. The Importance of sustaining a special journal of Geophysics in the English language, as representing the highest development of Geography (read by title).

Cleveland Abbe. A Modified Polar Projection adapted to Dynamic Studies in Meteorology.

L. A. Bauer. The Magnetic Survey of Oceanic Areas (read by title).

Isaiah Bowman. Hogarth's "The Nearer East" in Regional Geography.

R. M. Brown. Notes on the Mississippi River Flood of 1903 and on the floods of other years.

Henry G. Bryant. Notes on Some Results from a Drift Cask experiment (illustrated).

M. R. Campbell. The Santa Fe peneplain (read by title).

G. C. Curtis. Glacial Erosion in the New Zealand Alps (Summary by President Davis).

W. M. Davis. Physiographic Notes on South Africa.

N. M. Fenneman. An example of Floodplains produced without floods.

R. T. Hill. The Geographic Origin, History and Decadence of the Mexican Plateau, with a definition and description of the Western Sierra Madre (read by title).

E. Huntington. Border Belts of the Tarim Basin, Central Asia (letters presented by President Davis).

D. W. Johnson. Drainage Modifications in the South Eastern Appalachians (illustrated).

William Libbey. Physical Geography of the Jordan Valley (illustrated).

Lawrence Martin. Observations along the Front of the Rocky Mountains in Montana.

A. Lawrence Rotch. Proofs of the Existence of the Upper Anti-Trades (illustrated).

R. S. Tarr and Lawrence Martin. Observations on the Glaciers and Glaciation of Yakutat Bay, Alaska (illustrated).

Cleveland Abbe. The Present Condition, in our schools and colleges, of the study of Climatology as a branch of Geography; and of the study of Meteorology as a branch of Physics.

R. E. Dodge. The Organization of School Geography (read by title).

Martha Krug Genthe. Some remarks on the Use of Topographic Maps in the schools (illustrated).

J. Paul Goode. Commercial Geography for Secondary Schools (read by title).

F. P. Gulliver. Home Geography.

D. W. Johnson. Map Studies for engineering students: the classification of contour maps on a physiographic basis (illustrated).

J. Russell Smith. The Place of Economic Geography in Education.

P. S. Smith. Practical Exercises in Physical Geography.

As the Association has not yet provided for the regular publication of its proceedings, the offer of the American Geographical Society to devote all of the February number of the Bulletin that was needed adequately to present the papers and abstracts was accepted. Special effort has been made by the authors, in preparing abstracts of papers, fully to include all the more important features.

In opening the pages of the Bulletin to this extended report, the Society believes that it is presenting material which will be both interesting and valuable to geographers.

The officers of the Association elected for 1906 are as follows: President, Cyrus C. Adams; First Vice-President, Angelo Heilprin; Second Vice-President, William Libbey; Secretary and Treasurer, Albert P. Brigham; Councillors—W. M. Davis (three years), I. C. Russell (two years), H. C. Cowles (one year).

PAPERS AND ABSTRACTS.

AN INDUCTIVE STUDY OF THE CONTENT OF GEOGRAPHY.

BY W. M. DAVIS (Cambridge, Mass.).

(Presidential Address at the Second Meeting of the Association of American Geographers, December, 1905.)

The Need of Comparing Opinions.—One of the objects to which this Association may well direct its attention is the nature of the whole subject of Geography, under whose broad shelter our individual studies are carried on. If we work only in view of our chosen field within the whole area of geography, we lose something of breadth, although we may gain much in depth. Our work will become more serviceable to others if it is presented in such a manner that its relations to the whole subject are made clear. Not only so; we may often benefit ourselves by systematically setting forth the place of our individual studies in geography as a whole, for we may be thereby led to discover that the systematic sequence of parts is interrupted here and there by gaps, which can be filled by well-directed effort. We should, I think, all profit if in the presentation of papers at these meetings some attention were given to an exposition of the speaker's ideas concerning the part that his topic occupies in the whole subject; we should thus better appreciate our relations to each other; and this I hold to be important, for one of the manifest difficulties ahead of us is the possible lack of natural association and coherence between such topics as magnetic surveys of the ocean, the distribution of certain kinds of toads, and the deserts of eastern Persia.

But it is manifest that, if we should attempt to make exposition of our ideas concerning the relation of our own studies to the whole subject, we must have previously gained a tolerably definite idea of the nature of the whole. Very likely we each have some such conception. If so, it would be profitable to institute a collection and a comparison of opinions; though it can hardly be doubted that they would show much diversity.

Examples of Geographical Statements.—As a contribution towards such a collection of opinions, I propose to consider the nature or content of geography in this address; but instead of presenting an abstract definition of the subject, the problem will be regarded from the other side. There will first be presented a number of sample statements that are presumed to be geographical because they are taken from geographical works; these statements will then be analysed in order to discover their essential nature; finally, an attempt will be made to discover the nature of the whole subject of geography on the basis of the statements thus analysed—that is, to discover the content of geography on the basis of an inductive study. The statements to be presented are taken from a variety of sources—text-books, treatises, and journals; they are often condensed from the original.

Here, for example, is a first set of items or statements: There are three native states in the Himalaya which are independent of British rule. The rivers of southern Gascony flow in radiating courses. There are more than 300 asteroids. The average man has about 87 cubic inches of brain. The mean depth of the ocean is about two miles. A new map of France on a scale of 1:50,000 is in course of publication. Protozoa are the simplest forms of animals, consisting of a single cell. The magnetic poles do not coincide with the poles of rotation. Celtic is spoken in Wales, the Highlands of Scotland, and western Ireland. Cotton is produced in the southern United States. The fall of rivers is usually greatest in their upper courses. The Grand Duchy of Prussia became a kingdom in 1701. Cryptogams are flowerless plants. The Hindu-kush, the highest mountains of Persia, trend to the northeast. Australia has many marsupials, of which the kangaroo is the largest. Amundsen has successfully made the Northwest Passage.

If all these statements are truly of geographical quality, it follows that all similar statements would be of geographical quality also. We should then have, in a complete geography, accounts of all states, in the Himalaya or elsewhere, dependent or independent of British or of other rule; descriptions of the course of rivers in all parts of the world; additional facts about other bodies in the heavens besides the asteroids; accounts of man's other organs than his brain; details as well as averages of ocean depths; descriptions of multicellular as well as of unicellular animals, and of flowering as well as of flowerless plants; reports on old as well as on new maps of France and of all other countries, whatever their scale; other items concerning terrestrial magnetism as well as the position of the magnetic poles; reports of all sorts of voyages; accounts of the changes of all duchies to kingdoms or of kingdoms to duchies, and of other political changes as well; mention of the animals of other lands than Australia, and the products of other countries than our southern States; announcements of voyages in all parts of the world in all centuries.

The Complexity of Geography.—The first impression about so varied a collection of statements would be that the subject under which they are all properly included must be a sort of *omnium gatherum,* without any well-defined unity of substance. Such, indeed, geography has been thought to be by some critics. A closer examination of our materials must be made to see if we really have to do with a heterogeneous collection of incoherent facts, without continuity of thought or unity of discipline. It may be that some of the items above cited do not justly belong under geography, and that an enchainment not apparent at first may be found to bring the remaining items and their proper fellows into some systematic association.

On reviewing the statements given above it appears that some are concerned with matters remote from the earth and commonly associated with astronomy; that some are concerned with matters of a personal or technical nature; that a third group of statements contains accounts of inorganic features of the earth; and a fourth group of organic inhabitants of the earth. Let us examine these several classes to see in how far they may be justly considered geographical.

Excepting as an astronomical statement is found to be related to terrestrial matters in such a way as to throw light on them, it should not be considered directly or indirectly geographical, in spite of the mention of such a matter in a geographical text-book; for by common consent geography has to do primarily with the earth. Hence the mere statement of the number of asteroids should be excluded from our consideration. It may, however, be advisable to retain in elementary text-books certain statements concerning planets in so far as they serve to emphasize the globular form of the earth by showing that there are other bodies like it; and such mention of the sun and moon as is needed for the understanding of insolation in relation to climate and of gravitation in relation to tides; and such account of the stars as shall serve in the proof of the rotation of the earth and in the determination of the attitude of its axis. Nevertheless all of these items seem to be only indirectly associated with our subject; they do not aid us to discover the real nature of geography.

Technical and personal items may naturally be associated with geography, if the things and events with which they are concerned are of a geographical quality, as maps and explorations certainly are. The announcement of the publication of a new map or of the completion of a remarkable voyage is therefore a piece of appropriate geographical news. Accounts of old maps, of old voyages, and of old ideas are very illuminating in showing how the geography of to-day has been developed; but they belong more with history than with geography when presented in order of time.

Non-Geographical Statements.—Many of the statements under the two remaining classes, which concern inorganic and organic matters on the earth, are properly geographical, if we judge by the repeated occurrence of such statements in many geographical works. Yet we cannot believe that all statements about inorganic and organic matters on the earth belong under geography. It is easy to instance a number of such statements from geographical sources which can hardly be regarded as having any clear association with geography. Consider, for example, the following set of items, all taken from geographical text-books:

The gastrula stage occurs just before maturity in the sponge. All substances transmit electrical energy. Crystallization is explained by supposing that the cohesive force of molecules is not exerted equally on all sides. After 1810 several independent republics were formed in South America. The rosaceæ have regular flowers.

However interesting and useful these items of information may be, they can hardly be regarded as geographical, even under the very broadest interpretation of our subject. They have probably been added to the text-books from which they are quoted in the belief that they are worth knowing, and that the pupils in our schools will have little chance of learning them if they are not brought in under the popular subject of geography. I question the advisability of such a method of promoting popular education; but that is another story. Our problem is to distinguish these and many similar statements from a large variety of other statements concerning the inorganic and organic terrestrial matters, so as to know which ones are properly of geographical quality and which ones are not.

Statements involving Relations.—The best solution that I have been able to find for this problem comes from a consideration of such statements as are included in the following third set of extracts, which, like the other two, have been taken from geographical sources:

The people of the Dalmatian coast are largely engaged as fishermen on the Adriatic; here the Austrian navy obtains its best seamen. A number of gulfs and mountain ranges naturally divide the people of Europe into groups or nations. Some parts of Bengal are so favoured with rivers that almost every cottage has a navigable stream at its door, and the Bengalese farmer keeps his boat just as the English farmer keeps his gig. Northern Uganda is drier, rain often fails, grass is short, and dry-country animals, such as zebras and ostriches, abound. The level land near Lake Titicaca is of small extent, and is occupied by alkaline marshes subject to overflow; for this reason the Indians cultivate the slopes in preference, converting them into narrow terraced garden beds. The periodic or monsoon winds that blow alternately in one direction and the other along certain coasts, as between India and East Africa, have long been favourable to navigation and trade. In northwest France the farmhouses on the chalk uplands are gathered into compact villages around one or more deep wells, because the ground water there is deep below the surface and difficult to obtain; but in the valleys the houses are scattered, because each family can easily procure its own water supply with little trouble.

Geography, a Study of Relations.—These statements differ from some of those of the two earlier groups of citations, in that they each contain at least two kinds of elements, one of which stands in a more or less distinctly causal relation to the other. The statements vary, in that some of the relations suggested are relatively simple while others are more complex; and in that some statements are rather empirical while others are more fully explanatory; but they are all alike, in that they involve a relation of cause and effect, usually between some element of inorganic control and some element of organic response. As such, these statements are examples of the most generally treated material that I can find; and hence I am disposed to say that any statement is of geographical quality if it contains a reasonable relation between some inorganic element of the earth on which we live, acting as a control, and some fact concerning the existence or growth or behaviour or distribution of the earth's organic inhabitants, serving as a response; more briefly, some relation between an element of inorganic control and of organic response. The geographical quality of such a relation is all the more marked if the statement is presented in an explanatory form. There is, indeed, in this idea of a causal or explanatory relationship the most definite, if not the only, unifying principle that I can find in geography. All the more reason, then, that the principle should be recognized and acted upon by those who have the fuller development of geographical science at heart.

Geography as the Study of Location or of Distribution.—There still exists in some quarters a tendency to limit geography by definition to the study of location, leaving the study of all the things that are located to other subjects. There is so little support for this narrow view of the subject to be found in modern geographical books that it need not be further considered. Another and more widely-accepted definition treats geography as the science of distribution. This is particularly a British view of the subject, and at least one British geographer urges that the distributed things should not be regarded as belonging to geography at all; but his writings are broader than his definition. While location and distribution must always be important elements of geography, all geographical books give much attention to the nature of the things that are distributed, and all recent books give much weight to the relations in which the distributed things occur: hence relationship seems to me the primary principle of the two, and distribution takes a secondary rank. The thing must be known before its distribution can be serviceably studied. The division of the peoples of Europe into groups or nations in consequence of the division of Europe by gulfs and mountain ranges is a geographical relation, in which the unlikeness of the things distributed takes precedence of their distribution.

Indeed, if geography is only the science of distribution—that is, the regional aspect of other subjects—it would be hardly worth while to maintain the study of geography apart from that of the subjects whose regional aspect it considers. Moreover, if geography is defined simply as the science of distribution, then the distribution of anything at all is a fit subject for geographical study. Under such a definition the distribution of hypersthene andesite or of books of poetry would be part of our responsibility; but there is nowhere any indication that geographers feel responsible for the distribution of such things. Again, if distribution is given first rank, the regional or spacial occurrence of all sorts of things is thereby given so great an importance that an insufficient place would be left for the systematic consideration of geographical things; yet most books first present things of a kind together—that is, they present the subject systematically—before they take up the distributional or regional treatment of different kinds of things.

As a matter of fact, nearly every example that is presented in this essay as an example of a geographical relation might, if desired, be presented as an example of distribution; and nearly all statements of distribution may be turned around so that they shall enter into or constitute relations; hence the total content of geography would be much the same under either principle. The relations that could not be presented under the lead of distribution are those which are the same everywhere; but it seems to me rather arbitrary to include relations that vary from place to place, and to exclude relations that are world-wide in their uniform occurrence. For example, the composition of the atmosphere or of the ocean, always accepted as an appropriate matter for mention in elementary texts, deserves no place in geography, treated as the science of distribution, until the minute variations of composition from place to place are considered.

In any case, location and distribution are fundamental elements of geography, and maps of the lands and charts of the oceans are essential in its every chapter. In view of the importance of these elements, some are disposed to attach an undue value to surveying as a part of geography. But surveying properly belongs in geography about where writing belongs in literature; and if it is given higher rank the student may, by misfortune, turn his chief attention to the art of mapping instead of to a study of the things that are mapped.

Physiography and Ontography.—If the principle of explanatory relationship be adopted as a general guide to the content of geography, it follows that neither the inorganic nor the organic elements which enter into geographical relations are by themselves of a completely geographical quality; they gain that quality only when two or more of them are coupled in a relation of cause and effect, at least one element in the chain of causation being inorganic and one organic. When they are considered separately, but as if in preparation for an understanding of the causal relations in which they will be later presented in the study of geography proper, they may be considered sub-geographic; and then the inorganic elements may be called physico-geographic or physiographic; and the organic elements may be called ontographic. Common usage recognizes the first of these divisions, but not the second, as we shall see later. It is well to emphasize the clause, "as if in preparation for an understanding of the causal relations in which they will later be presented in the study of geography proper;" for many items which, under this proviso, are of physiographic or of ontographic quality, may under another proviso belong in other departments of knowledge.

Physiographic Matters.—This may be made plainer by citing particular cases in which a number of different topics, familiar from their occurrence in books on geography, will be seen to fall under other subjects when they enter into non-geographical relations. For example, the size and rotation of the earth and the general movements of the tides are undoubtedly physiographic elements, yet both may be treated appropriately under astronomy when they are considered in their relations to other planets. Sea-water, when regarded as a liquid compound which holds various salts in solution, may be studied properly by the chemist with regard to its composition; nevertheless sea-water, as the medium in which organic forms live, is an indispensable subject for physiographic inquiry. The horizontal strata of plateaus are a fit topic for geological investigation, as regards their origin and history; but they are no less a subject for physiographic investigation as affecting present form. It, therefore, seems impossible to determine, merely by a consideration of the thing studied, whether it belongs to physiography or not.

A given object may belong under several different sciences, and may be treated in text-books on different subjects; it is the relation into which the object enters that determines its place.

There are, however, certain inorganic topics, commonly found in geographical books, which seldom, if ever, enter into relations with organic topics, and which would, therefore, under the strict application of the principle of relationships, be ruled out of physiography, and thus out of geography also. Such are cirrus clouds and haloes, the crevasses and blue veins of glaciers, and the polar flattening of the earth. Nevertheless, most or all of these topics will probably hold their places in books on physiography, because they serve to complete the picture of the whole earth as the home of life. In any case, little is gained by a very strict or over-logical application of a useful principle of classification in a problem such as we are considering.

Ontographic Matters.—The determination of the science under which a thing belongs by means of the relations into which the thing enters is an even more important guide in ontography than in physiography. For example, one may read in a certain text-book of geography that all forms of life consume food. In so far as the assimilation of food and the organs by which it is accomplished are concerned, the consumption of food belongs under physiology; but the consumption of food is an ontographic matter in so far as it brings an organism into contact with the rest of the world and thus causes it to enter into geographical relations.* Commercial geography is largely concerned with relations that grow out of this element of ontography. Water is essential in organic processes of many kinds. This is, again, a physiological matter, if it is examined with reference to the processes of circulation; but it is ontographic when it is found to lead to a relation with the sources of water supply; villages gathered around deep wells on the chalk uplands of northwestern France are examples of the geographic relation thus brought about.

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* As thus defined, ontography is more narrowly limited than in my paper on "A Scheme of Geography" in the Geographical Journal for October, 1903, where it was made practically to include the relations or responses which responding organisms enter into with their inorganic controls. Defined in that way, ontography is too nearly identical with biogeography, or, indeed, with geography As here limited, ontography is not the study of the organic response, which is practically equivalent with the geographical relation itself; it is simply the study of the organic act or deed or motive which results in a response or relation when a physiographic control is encountered.

Plants and animals tend to diffuse themselves or to be diffused over the earth. This is a fundamental fact, usually associated with the study of biology; but the limits of diffusion and in many cases the means of diffusion are determined by physiographic controls, hence the tendency to diffusion is an ontographic matter.

The need experienced by all forms of life to secure food, already instanced, leads to many other relations than those of commercial geography. The need of food is satisfied without going in search of it if the food is contained in a moving medium that surrounds the organism; hence those organisms that live chiefly upon food contained in one or the other of the two great mobile envelopes of the earth, the atmosphere or the hydrosphere, are often rooted or fixed: the air or water currents carry the needed food to the waiting plant or animal—and this is surely too important a geographical relation to be omitted from a broad consideration of our subject. Other organisms take advantage of the currents of air or water to be passively carried about by them, taking their food when they happen to come upon it. If they are land-dwellers, they are so small that they can easily be wafted about by the winds; if they are dwellers in water, they may gain greater size by assuming about the same specific gravity as that denser medium, so as to float easily in its perpetual currents*. Still a third class of organisms move of their own volition; and in connection with these there are all manner of geographic relations. Some of them involve the development of wings, whereby motion can be effected in the comparatively unsustaining air, as in the case of many insects and birds, of a few mammals, and formerly of some reptiles; some involve the development of fins to produce motion in the sustaining water. These examples are as good illustrations of organic responses to inorganic controls as are the canoes and the steamships of uncivilized and of civilized man.

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* If the substance of this relation were treated under the principle of distribution, it could be presented as follows: Organic forms that have no means of locomotion of their own, but depend on a moving medium for their transportation, are of unlike size, according as they occur on the lands or in the ocean. If they inhabit the lands they are of minute, even of microscopic size, so that they may be carried about by the winds of the unsustaining air; they may be of larger size if they inhabit the ocean, for there they so closely imitate the specific gravity of the water that they float about with its perpetual currents.

It follows from the preceding paragraph that the more closely our standard geographical material is examined, the more clearly it appears that its ontographic as well as its physiographic elements may fall into other sciences when they are treated in other relations; and that they become most distinctly geographic when they enter into the causal relations of the kind set forth above. The rise and fall of the tides is a physiographic matter when it is seen to determine the distribution of certain forms of life, such as barnacles, or to influence the availability of harbours for the entrance of shipping; the occurrence of coal is a physiographic matter when it is found to influence the industry of a district and the commerce between nations; the small size of spores, pollen, and germs is an ontographic matter when it is seen to be related to their transportation by the thin air; the sensitiveness of organisms to temperature changes is an ontographic matter when it is shown to affect the distribution of plants and animals over the earth. Yet all these matters may be treated with entire justice under other sciences than geography. It is, therefore, to my reading, of capital importance in determining whether a statement is of geographical or sub-geographical nature to know how far it constitutes or enters into causal relations of the kinds that have been here considered.

Is Ontography a Part of Geography?—It is perfectly true that many of the illustrations just given are not commonly regarded as belonging under geography; but it seems to me that their exclusion is illogical and arbitrary. They are practically all to be found in certain standard geographical works, and many more might be taken from such books as Ratzel's Anthropogeographie and Beddard's Zoogeography. The general principle by which one should be guided in determining the relevancy of such matters is as follows: If a certain relation between an inorganic control and a responding organism is a geographic relation, then all similar relations are also geographic. For example, a well-known text-book makes the statement that water-plants are supported by the relatively dense medium in which they grow, and hence do not need strong woody stalks such as many land-plants have. This is an excellent example of a geographical fact: it involves a relation between an organic growth and an inorganic medium.* But the flight of birds, the small size of germs, the essential agreement between the specific gravity of fish and of water, the universal habit of breathing oxygen, all involve similar relations. The first example seems to me undeniably geographic; the others are no less so. To exclude the latter from geography while including the former would be to set very arbitrary limits to our subject.

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*If stated in terms of distribution, this might be phrased as follows: Plants with stems and branches strong enough to support their own weight grow on the lands, where the air is too light to buoy them up; plants with weak stems grow mostly in the sea, where they are held up by the heavy water.

It may, perhaps, be objected that flight and breathing are processes of too ancient origin to be considered as geographical; but inasmuch as they are maintained into the present time, by inheritance through persistent conditions of environment, they have the same right to a place under geography as is enjoyed by such examples as the prevalence of the fishing industry on the Dalmatian coast, or the custom of the French farmers on the chalk uplands of living in compact villages; for these habits, also, are not independently originated by each man who follows them, but are continued by inheritance through persistent conditions of environment.

There are certain matters, frequently encountered in text-books of physical geography, which belong better, as it seems to me, under ontographic relations. Such are the distribution of plants and animals, and the races of man. The association of such topics with physical geography is probably the result of conceiving all the rest of the subject as contained under political geography. The contrast of physical with political conditions may serve well enough in elementary books, where the distribution and behaviour of man are the chief subjects in political geography, and where plants and animals are therefore thrown in with physical geography; but in the more advanced and general treatment of the subject such an arrangement is not satisfactory. It does, however, seem legitimate to introduce as often as desired ontographic responses in a physiographic text, in order to show at once the kind of response that certain controls call forth, and thus to impress the fact that the physiographic items are really related to ontographic items: a similar introduction of physiographic items is appropriate in chapters on ontography. This practice is followed by certain writers.

There are three definite positions and many indefinite positions that might be taken with respect to the attention that should be given by geographers to organic considerations. The narrowest position limits geography almost entirely to the inorganic features of the earth—that is, to physical geography or physiography. This is the view of geography held by some historians, who take unto themselves practically all the human element that is so commonly encountered in political geography. An intermediate position would include physiography and the more manifest relations into which it enters with various forms of life, and particularly with man, but would not accept responsibility as to the less manifest responses of various living things. This seems to be the position taken by many geographers, more or less consciously. The third position would treat ontography as thoroughly as physiography, and would search for all the geographic relations of physiographic controls and ontographic responses. This is certainly the broadest of the three positions, being, as many would feel, too broad, and involving too much overlapping upon other subjects. For my own part, there seems to be so manifest a necessity of gaining a responsible knowledge of ontography, at least of elementary ontography, before geography proper can be successfully treated, that ontography should come to be regarded as a part of it. The analytical and inductive methods of this paper, therefore, lead me to adopt the third position; and I believe that this position is essentially consistent with the opinion of writers who, like Ratzel and Reclus, have cultivated the most advanced or matured stage of geographical science.

The Importance of Explanatory Relations.—Although various facts which may make parts of relations between inorganic controls and organic responses, or which are met with in preparation for an understanding of such relations, thereby gain a most characteristic geographical flavor, a very brief review of geographical books will suffice to show that many statements there included do not explicitly possess this flavor. In the first place, in the older books the idea of relationship had no distinct recognition. That was the time of memorized names of capes, of empty boundaries, of unexplained lists of products. Almost anything about the earth or its inhabitants was then accepted if it reached a satisfactory degree of what is called "importance." In the newer books, the principle of explanatory relationship is very generally acted upon; there are, nevertheless, many relations stated so empirically that the pupil may fail to gain them a full appreciation of the best essence of geography. Consider, for example, the following statement from a good text-book: Some form of Celtic is spoken in Wales, the Highlands of Scotland, and western Ireland. This is nothing more than an empirical statement of a fact of distribution. Many a student might memorize such an item without gaining any clear insight into its geographical meaning. The real point is that the early inhabitants of Great Britain, being attacked by invaders from the continent on the east, survived only where pursuit was difficult, as in the rough ground of Wales, in the rough and distant ground of the Highlands, or in the distant and isolated ground of Ireland;

and hence only there the early language is still preserved. The fact that Celtic, as Celtic, is spoken in certain parts of Great Britain belongs to philology as well as to any other subject; the fact that Celtic is the language that was once spoken generally through Great Britain might come under history as well as under any other subject; but the fact that Celtic is still spoken in rough, distant, or isolated parts of Great Britain, because of their roughness, distance, or isolation, is a local example of an important class of relations between controls and responses, and as such it belongs distinctly under rational geography.

The Expansion of Geography.—Geography has still much progress to make. There is not only much to be done in the way of exploration of little-known lands and seas, but many of the more civilized countries still merit closer study than they have yet received, if we may judge by the notable incompleteness of the best handbooks and treatises. One method of carrying the subject forward consists in outdoor observation; and this method cannot be too highly recommended to those who wish to contribute to the fuller development of our subject. When we realize that we have no modern and maturely-developed account of the geography of such a state as Virginia, or Ohio, or Colorado, or California, it becomes evident that abundant opportunity for exploration lies near at home. But there is a second method by which geography may be promoted—that is, by thinking about what we see, and thus expanding every example of a geographical relation that we find to its farthest legitimate extension. Take, for example, the common case of a road which runs through a notch in a high ridge; such a detail of location is a response of the ontographic element, movement, to the physiographic control, gravity; hence all such responses to gravity should be searched out so that they may be systematically treated as to kind, and regionally treated as to distribution. Such matters are surely as properly of a geographical quality as are various responses to sunshine which are always found among the standard matters of our books. How many more responses to the universal and persistent force of gravity there may be, we do not yet know. Again, take such an example as that afforded by the habit of working by day and summer and resting by night and winter. These are responses to the controls of light and heat in contrast to darkness and cold, which result from the illumination and warmth of the rotating and revolving earth by an external sun. This suggests that all other responses to light and to darkness should be sought out and studied; for it leaves the limitations of our subject very vague if we make a beginning with such relations and do not carry them to an end; it makes the limitations very arbitrary if we make a beginning of such relations and stop with the first or the second or the third example, instead of pressing on to the very last.

It is an application of this same principle that makes it impossible to limit the organic side of geography to man; for the habits which man has developed in his search for food, clothing, shelter, and so on are in very many ways closely analogous to those developed by animals in a similar search. In the same way the sensitiveness of man and animals to climatic conditions by which limits of distribution are so largely determined is paralleled by the sensitiveness of plants to similar conditions. Life is a unit; if one form of life comes under the study of geography because it responds to physiographic controls, then all forms of life come under geography.

The expansion of geography through time is likewise inevitable, unless it is most arbitrarily limited to the "present day." Precisely the same principles have been embodied in the relations between physiographic and ontographic elements in the past as are embodied in them now. It is, therefore, most illogical to think of geography as a science that deals only with to-day. There has always been a geography, all through the geological ages; geology is the integration of all its momentary or geographical differentials. We may never know very much about the successive geographies of the past; but all the fragments that have thus far been learned assure us that it was of essentially the same order as the geography of the present. The recognition of this principle is of the greatest importance to geography and to geology as well.

The Subdivisions of Geography.—It is but natural that the different phases of human geography should have been more fully developed than the other branches of our science. Political geography, frequently overrunning civics, economics and history, has long been familiar as an elementary subject; but with us it has seldom been carried into the higher reaches of education. Commercial geography is rapidly gaining an important place in our schools, and is meeting the danger of becoming almost as empirical as the old-time lists of products of the several States. Biogeography has several parts. Anthropogeography, as expanded by Ratzel, seems destined to become an important subject in the universities, because of the greater insight that one gains through it into history. Zoogeography and phytogeography are, in my opinion, as a rule, too strictly limited to facts of distribution alone; these divisions of the subject should be expanded so as to include for animals and plants a consideration of what would correspond to the political and commercial geography of man. Paleogeography is occasionally treated, but it must always be a fragmentary subject, because it is based on fragmentary records; it will, however, be better treated by geologists in proportion as they have had geographical training.

The growth of explanatory treatment, which makes so characteristic a difference between the content of geography in books of a hundred years ago and of to-day, is chiefly due to the different amounts of general knowledge in stock then and now, and consequently to the different philosophies then and now prevailing. The subject has thus gained greatly in strength, in disciplinary value and in living interest. At the same time, geography has come to cultivate more and more—some would say, to trespass more and more—upon the fields that are also cultivated by other subjects. If the trade-winds are not simply described as to region of occurrence, direction of blowing, weather conditions therein prevailing, and so on, but are also explained as parts of an extensive convectional circulation between equator and poles, modified by the deflective effect of the earth's rotation, all this explanatory matter has a strong flavor of physics. If the occurrence of plants of a certain kind in a given region is not merely asserted, but is shown to be the result of climatic conditions to which the plant responds owing to its sensitiveness to temperature and moisture, this closely resembles certain chapters of botany, and the same may be said regarding the relation of animal distribution to zoology. If the boundary of a state, the location of a city, or the industry of a district is rationally explained instead of empirically stated, the explanation is of a kind likely to be found in books on history and economics. Shall we, then, in view of this, relinquish explanatory treatment to other subjects and content ourselves with empirical statements? Shall we adopt the limitation to the location of things, as above suggested, and thus avoid duplication with other subjects? No. Duplication is unavoidable; and, moreover, it is reciprocal. The historian, as well as the botanist and the zoologist, must borrow from the geographer all manner of facts regarding location, extent, distribution, climate, form, movements, products, populations, and so on; the geologist can hardly make a step into the realm of the past without having made preparatory study of the present. Overlapping and duplication are unavoidable. We must each of us try as far as possible to concentrate upon his own subject; but we must at the same time borrow and quote with the utmost freedom from any other subject that will give us aid in the consideration of our own.

Examples of Helpful Duplication.—One of the most interesting fields that I have run across in geographical research is that open common where geography and philology overlap. It has often been remarked that the Arabs of the desert have many terms for sand dunes, evidently because they are familiar with the many forms that sand dunes there assume; their language has developed in a peculiar direction as an ontographic response to their peculiar physiographic environment. In the same way, the people of the Alps have various terms by which to name mountain summits of different shapes; this is another ontographic response to a peculiar physiographic environment. But there are other less manifest examples of a somewhat different kind. We treasure as a fine geographic example the long preservation of ancient forms of speech in remarkable purity in Iceland, an out-of-the-way island; and, by way of contrast, we like to mention Malta, an island that is very much in the way, where the mingling of peoples has resulted in the mixture of Arabic and South-European tongues. We have already called attention to the diffusion of organic forms as a fundamental ontographic fact, and we know that variation is an ontographic consequence when diffusion leads to a physiographic environment that involves separation as a result either of distance or of isolation. As examples of this sort of geographic relation, we may point either to the several species of cassowaries on the islands of Australasia; or to the several races of man on the larger divisions of the lands, where barriers formed by the oceans are supplemented by a desert barrier in the Sahara and by a mountain barrier in the Himalaya; or to the several nationalities in Europe, where gulfs and barriers are so important. But why not continue this line of inquiry, and instance, as another example of variation following on diffusion and separation, the differentiation of the Romance languages from Roumania to Portugal, and thus bring in the interesting story of the division of the Langue d'oc and the Langue d'oui by the central highlands of France? Why not include the even more extraordinary story of the words *pecuniary* and *fee*, which have come to look so unlike on their arrival in our composite language, because of their different paths of travel from their common source? This is of just as good geographical quality as is the contrast between the whites and the blacks in our southern States; they began alike somewhere long ago, and have come to be different through long ages of separation before they are again found together: and separation is an important element of physiographic control.

Not only speech but figures of speech are affected by physiographic environment. There are two examples of far-separated maritime peoples who were so impressed by the manner in which a boat is guided by its rudder that they both came to use a word, which primarily meant a stick and secondarily a stern oar, in a later figurative sense, meaning the guidance or control of a whole people. One of these examples is found with the Scandinavians, where the same word is used in "the helmsman *steers* the boat" and in "the king *steers* the people": here the original and the figurative meanings of the word both survive to-day. The other example began with the people of the eastern Mediterranean, and is now spread through all the Romance languages, and into the Romance element of English. French still preserves the original sense of the word in *gouvernail,* for rudder; but we have lost that sense, unless perhaps in a passage in the Bible concerning the "governor" (helmsman or captain) of a ship, and only know the figurative sense: the word "govern" is therefore a long-lasting response to an early maritime environment. In both these cases it is as legitimate to instance an effect of environment on language as to instance its effect on industry.*

The Practical Value of Defining the Content of a Subject.—In occasional conferences with some of our members on such questions as have been treated in this address, I have gained the impression that they attached relatively little value to abstract considerations, and that it sufficed them to go on with their work without inquiring particularly into the general content of the subject under which it belonged, without attempting to develop what may perhaps be called the more philosophical view of the subject as a whole. There was a time when I shared this indifference to abstract inquiry —a time when I was, as it were, overwhelmed with the great quantity and variety of material with which I had to make myself more or less familiar, and when there seemed to be no more need than there was occasion of bringing it all under an orderly and systematic scheme. But that time is now a good many years ago, and since then I have passed out of the stage of life in which, we are assured, our original work is to be completed, and have entered well upon the later stage in which the contemplation and arrangement of work previously done is, we were told, more attractive than the accomplishment of new work. It is, perhaps, for some such reason that this opportunity for addressing the Association has been devoted to the reading of an essay on the content of geography as a whole, rather than to a report on more concrete matters, such as certain recent observations in South Africa. Nevertheless, I am persuaded that there is a practical value in abstract considerations such as I have presented, even for younger men, and that if a general scheme of work in accordance with some broad and philosophical view of one's chosen science is formulated by a young geographer early in his career, he will profit greatly from it; for he will thus be led more surely and directly to detect all the facts that are pertinent to any inquiry he may enter upon. Such a scheme is always open to modification as experience increases. If the geographer undertakes field study, as I hope he may, either at home, where there is still plenty of field work to do, or abroad, where there is still more to be done, it will serve him well to know as definitely as possible the essential quality of the work before him. If he wishes to become an all-round geographer and to give a thorough geographical account of the region of his field work, he will be greatly aided in keeping his eyes open to the facts before him by bearing in mind the systematic content of the science as a whole, a part of which he proposes to study in the region he has selected.

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* Since presenting this Address, a missionary has told me, in response to the question: "What is the Arab word for *govern*, and what is its origin?"—"It is a word that means *guide*, and is derived from the word meaning to guide a horse."

GEOGRAPHICAL NOTES ON THE WESTERN SIERRA MADRE OF CHIHUAHUA, MEXICO.

By Edmund Otis Hovey (New York City).

Abstract; Illustrated.

The elevated central plateau of Mexico is considered to be a fault block bounded on the east, south, and west by important zones of fracturing and uplift. The controlling faults run N.W.-S.E. and E.-W. The block rises gradually, but not uniformly, from the south toward the north and from the east toward the west. It is not separated structurally from the plateau region of the western United States. Volcanic flows and tuffs form the major portion of the surface material, and most of the remainder has been derived from eruptive rocks. The plateau is, in general, arid or semi-arid, and even the highest parts do not receive a copious rainfall, on account of the line of high mountains and escarpments along the western edge of the elevated block. Bolsons, or pocket-deserts, are numerous over the strictly arid eastern and central parts of the plateau. Many

of these bolsons contain lagunas which receive the waters of the streams from the mountains, but have no outlet.

A journey undertaken for the American Museum of Natural History during the winter and spring of 1905, in company with Prof. R. T. Hill, enabled the author to observe the plateau from Ciudad Juarez southwestward and southward into the heart of the western Sierra Madre for a distance of about 500 miles through a region which is practically unknown to American geologists. The principal lesson which was impressed upon the mind was the geographic cycle in the desert or semi-desert. Stress was laid upon the strains due to the great diurnal variations in temperature as an agent of the highest importance in the breaking up of the rocks. Transportation down the slopes is due to gravitation, sheet-floods, and winds. Wind performs an immense amount of work in a region under a dry climate, not only in transportation but also in sculpture. Its action is very variable. Bolsons are found in original basins between the volcanic centres, or in basins made by the wash and slide-rock coming down from the disintegrating mountains.

The inclosed basins of the high plateau of the Western Sierra Madre are no longer arid; but they have had a history like that of the bolsons, and they are an indication of the previous existence of a more arid climate than now exists in the high mountains. The drainage systems of the high plateau are of great interest. There are streams like the Casas Grandes with sources in the great cordons which flow out into lagunas in the deserts. Other streams discharge into lagunas in the high inclosed basins like the Llano Bavicora. The headwaters of some of the streams are cutting back into and capturing the drainage of inclosed basins, as at Llano Cristo on the Hacienda San Miguel.

The Pacific drainage (into the Gulf of California) is gradually eating its way eastward through the Western Sierra Madre and capturing the internal drainage. The Aros has thus captured the Mulatos, the Tutuaca, the Chico, and the Verde among the large streams, which are trunk streams gathering the waters of hundreds of consequent streams draining the cuestas. The main trunk of the Aros flows in a direction directly contrary to the consequent streams on the cuestas. It is the main tributary of the Yaqui River. In the magnificent grand cañon of the Aros and along its tributary arroyos are exposed many local "basin conglomerates" which indicate the location of extinct inclosed basins, or bolsons. The sharp V-shaped cross section of the great cañon denotes its still youthful stage.

The paper was illustrated with lantern-slides from photographs made by the author for the American Museum of Natural History.

LAKE LOEN (NORWAY) LANDSLIP OF JANUARY, 1905.

By A. P. Brigham (Hamilton, N. Y.).

Abstract; Illustrated.

Lake Loen is one of three lakes occupying a radial position at the head of Nord Fiord, and is surrounded by steep-sided mountains four to six thousand feet in height. The slip occurred about midnight, January 15, near the head of the lake. A veneer of talus slid from a rock slope 2,000 feet in height, raised the adjacent lake floor from a depth of 30 fathoms to 10, and sent waves across to neighbouring settlements, destroying strongly-built houses and occasioning the loss of 61 lives. A small steamboat was stranded on the opposite side at a height of 40 metres above the lake surface. The waters were raised 6 metres at the foot of the lake, about six miles away. The duration of the catastrophe was about two minutes.

HOGARTH'S "THE NEARER EAST" IN REGIONAL GEOGRAPHY.

By Isaiah Bowman.

Abstract.

"The Nearer East" illustrates a method in Regional Geography and helps as well toward a better conception of Systematic Geography. "The Nearer East" includes Greece, the Russian Baltic and Caspian Provinces, Armenia, Syria, Persia, Arabia, and Northwestern Africa. The region thus circumscribed is considered a natural province or region on the basis of similar or closely-related climatic, topographic, and ethnographic qualities, coupled with a certain distinction of position between Central Europe on the one hand and the Farther East on the other. The boundaries are in part political and subject to change; in part physical, and in so far relatively unchangeable. The basis of division indicated is more specific than in the system suggested by Wallace. Herbertson's boundaries of the "Natural Geographical Regions" (*Geographical Journal,* Vol. 25, 1905, p. 309) are drawn on the same basis, but the difference in the location of the boundaries is perhaps to be attributed in part to the limitations of publication in the case of Hogarth's work. Structure (geology) is placed after the chapters in which the topography is discussed instead of being made incidental to topography. A distinct feature is the division of the book into two parts, in recognition of the two-fold character of Geography.

The first part deals with the physical conditions exhibited in the region; the second part deals with man, his distribution, grouping. life conditions, etc. The distribution and occasionally the interrelations of plants and animals are discussed, but separate chapters are not devoted to organic responses of this type. We have here, then, a treatment differing from that of the anthropogeographer, in that it includes a large part of all the ontographic responses found in the region, though systematic arrangement of the human responses only is attempted, plant and animal responses being treated as secondary phenomena which are included only in so far as they become factors in more or less immediate control of man's distribution, grouping, etc. Vivid and pleasing landscape descriptions influence very profoundly our interest in geographical study, and the chapter on "Physical Circumstance" is certainly a good illustration of such description.

"GLACIAL EROSION IN THE NEW ZEALAND ALPS."

BY GEORGE C. CURTIS (Boston, Mass.).

Read by Title. Abstract.

In 1902 an account* was published by two eminent European scientists, stating that after examination they were disappointed to find in New Zealand no signs of recent glacial erosion, such as are recognized nearly everywhere in the European Alps and in Norway.

These geologists saw but one side of the lofty northeast-southwest range of the New Zealand Alps; had they made the rough trip to the western side, they doubtless would have reported differently.

In contrast to the sharp peaks and aiguille topography of the Swiss Alps, the New Zealand Alps are remarkable for their great talus-slope development, which is considerably more prominent on their eastern side; the predominance seems due largely to the presence of morainal dams which block and retard the disposition of the waste from the mountains above; the processes of erosion are thus checked to such a degree that the vast amount of waste characteristic of lands in this stage of development collects in the upper valleys and piles up from the bases of the peaks until their lower crest-lines are nearly smothered. Thus the surface bed-rock is much covered and protected, and the transportation of its waste is comparatively slow, accounting for its loose and broken condition high above, as well as at the surface of the large valley glaciers. The prevailing absence of signs of recent glaciation on the eastern side may be accounted for by these conditions, which do not permit of sufficient resistance in the rotten bed-rock to offer a chance for abrasion by the moving ice.

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* 1st An. Rep. N. Z. Govt. Health and Tour. Dept.

On passing over the range to the western side (where the morainal dams have been cut away) a difference of conditions immediately manifests itself; talus is less conspicuous, and glaciated surfaces are quite apparent. Along the lower portions of the somewhat smaller glaciers of this side, not only do we find evidence of past strong glacial erosion in the terraces gouged deeply in the smoothed and grooved bed-rock of the valley sides, but glacial cutting and striations on the rock at the very edge of the ice, where the action of grooving and gouging may literally be observed in process. On the surface of the medial and lateral moraines, especially in the vicinity of the enormous terminals, I found not only freshly-striated but freshly-polished blocks—additional evidence of glacial erosion.

PHYSIOGRAPHIC NOTES ON SOUTH AFRICA.

By W. M. Davis.

Abstract.

The speaker had opportunity last summer, as guest of the British Association for the Advancement of Science, to visit South Africa and to gain a general view of that region during a land journey of thirty-three days. In the southwest, the north-and-south ranges of heavy Table-mountain sandstones rise, ragged and treeless, between lowlands of erosion available for agriculture; several of these ranges are of synclinal structure. The Table-mountain range itself is one of this system, with Capetown at the northern end and Cape of Good Hope at the southern end; it is tied to the mainland by a low sandy belt, apparently wave-built. Farther inland the east-and-west anticlinal ranges of various sandstones rose, with simpler forms and extended surfaces of bare rock, over lowlands and hilly belts with a scanty vegetation adapted to the arid climate; a large part of this district is too barren for successful occupation, except in small and far-scattered farms where water supply is available. The rivers here have cut deep gaps in the ranges. The plateau country, farther in the interior, is of horizontal strata in its southern part and of disordered strata or of granite in its northern part; its altitude is from

4,000 to 6,000 feet. It is for the most part a widely-extending peneplain, interrupted by more or less numerous monadnocks in the form of knobs, ridges, and tables of volcanic and other resistant rocks. Most of the streams of the plateau do not incise new valleys beneath its gently-undulating surface until they approach the border of the high ground; there they descend by strong slopes with many rapids and falls. The short streams of Natal are encroaching by headwater erosion on the longer streams of the Orange river system, where the two rise against each other in the eastern part of the plateau country. The region is treeless over the greater part of the area visited, but a thin forest of irregular and awkward trees was passed through in western Rhodesia on the way to the Victoria falls of the Zambesi river, whose zigzag gorge, worn in horizontal sheets of basalt, is a striking example of young river erosion.

The plateau country is for the most part available for cattle-raising where water can be had; but the number of cattle seen was small, owing to the losses during the Boer war and to the ravages of cattle diseases afterwards. The rarity of lofty mountains rising above the plateau leaves the streams dependent almost entirely on the irregular summer rains, and therefore subject to great fluctuations in volume. Irrigation is needed, but is not easily accomplished.

FLOODPLAINS PRODUCED WITHOUT FLOODS.

By N. M. Fenneman (Madison, Wis.)

The word "floodplain" is probably associated in most minds with floods. When not thought of as denoting a surface built up by the sediments from flood waters, it is generally understood to imply liability to occasional overflow. Several of the modern textbooks of Physical Geography (Davis, p. 286; and Tarr, p. 288) speak distinctly of another process which contributes to the building of floodplains—namely, that of lateral accretion on the inner side of a meander curve. It may be profitable to point out more explicitly that (1) there are two distinct processes, either of which is capable of producing floodplains; (2) these correspond to the two recognized modes of transporting undissolved material—that is, by suspension and by rolling on the bottom of the stream; (3) either one of these processes may produce a floodplain without the co-operation of the other, and (4) examples of floodplains so produced may be pointed out.

Wherever a stream meanders, it digs away its outer bank while the inner is building up to the water-level by the deposition of material brought there by rolling or pushing along the bottom. This is *lateral accretion.* Its characteristics are—(1) coarseness of the material, which is frequently sand and may be cobbles or boulders; (2) a rude cross-stratification dipping streamward at the angle of the bank's slope; (3) a smaller streamward slope of the finished plain if the stream be a cutting one.

If the stream be subject to overflow, sediment must settle from suspension in beds conforming to the surface. This is *vertical accretion.* Its characteristics are (1) the fineness of the material, mud; (2) the approximate horizontality of the laminæ. The resulting surface may slope either toward or from the stream according as the stream is degrading or aggrading its channel. If the two modes of accretion co-operate, the contribution made by each may be detected by the nature of the material and its bedding. Commonly a section of a floodplain or terrace will show the coarse accumulations of lateral accretion below, covered by the fine alluvium due to vertical accretion.

The building of floodplains by vertical accretion alone, while entirely possible, must involve peculiar conditions—for example, human agency—to prevent meandering. The opposite case is exemplified in the following illustration.

White River, the outlet of Lake Geneva in southern Wisconsin, presents in diagrammatic perfection a floodplain built by lateral accretion alone. The lake has an area of 8½ square miles, and it therefore acts as a regulator of the river's flow, the extreme recorded variation in the water-level being 27 inches. In seventy years the stream is known to have overflowed but once, and then only by the breaking of the dam at the outlet. As the floodplain suffered no important change on this occasion, the event may be disregarded.

For at least a fourth of a mile below the outlet, White River flows between steep bluffs of coarse glacial gravel, bordering a floodplain about 400 feet wide. Through this plain the stream flows in tortuous meanders, the channel being somewhat more than two feet deep. Those banks which are being excavated by meanders show the re-deposited kame gravels not covered by any finer material except the remains of decaying vegetation. The facts made plain by these observations are as follows: (1) This floodplain is due entirely to planation and lateral accretion, floods not co-operating. (2) The plain is not aggrading, and cannot in the nature of the case do so. (3) These facts might be determined from the structure of the plain itself without human testimony concerning overflow. (4) Similar instances are probably abundant on streams whose flow is regulated by lakes or swamps.

THE BORDER BELTS OF THE TARIM BASIN.

By Ellsworth Huntington (Milton, Mass.).

[The following description is taken from letters written by Mr. Huntington to Professor Davis during a journey as a member of Mr. R. L. Barrett's expedition to Central Asia.]

Khotan, Chinese Turkestan, 12 July, 1905.

The Tarim basin is bordered on the south by a series of concentric zones. Where we entered the basin, southwest of Khotan, the zones are as follows:

1. The Plateau Zone lies at a height of from 15,000 to 18,000 feet. Its gentle slopes afford abundant soil, and there is a fair supply of water. The temperature is so low, however, that no vegetation can grow except large orange-green lichens and an occasional bit of grass in some low, sheltered spot. The only animals are wild sheep, which seem able to live on the lichens and grass, and ravens and wolves, which eat the carcasses of the dead animals of burden. On the main road the ravens were numerous, but as soon as we left it they disappeared.

2. The Granite Mountain Zone rises on the northern edge of the plateau to a height of 24,000 feet, and descends on the north to 15,000 feet. There is plenty of moisture, mostly in the form of snow and glaciers, but the slopes are too steep to hold much soil and the temperature is too low to support plants. Therefore it is practically lifeless.

3. The Mountain Pasture Zone includes the heads of north-sloping valleys from an elevation of 11,000 to 15,000 feet. Between the valleys rise mountains partaking of the character of one or the other of the adjacent zones. Old moraines deeply covered with loess at the heads of the valleys, and steep slopes of loess lying against the valley sides farther down the valleys furnish abundant fine soil. The proximity of the high mountains causes frequent light rains during summer. For from three to five months the temperature is fairly warm. Accordingly, abundant grass flourishes. Marmots are almost the only wild animals. Man has taken advantage of the rich grass for his flocks and herds. As the pastures are only available for three months, he must be nomadic. The

limited space afforded by a steep-sided mountain valley makes it impossible to move freely from place to place. Moreover, the winter pastures at lower levels are also restricted. Hence nomadism has not that full development which exists to the west and north, where the relatively low plateau zone is covered with grass and allows free movement. Year after year the same people of this region come to the same place. They live in poor, low tents or in caves in the loess. The women are generally left behind.

4. The Paleozoic Mountain Zone extends from near the stream sources down to an elevation of about 7,500 feet; here the streams run in narrow gorges cut in metamorphic Paleozoic strata. The sides of the valleys and the sheltered parts of the intervening ridges are often covered with dissected deposits of loess. At a little distance from the high zone of granite mountains the precipitation decreases greatly. Thus, though the temperature is propitious and there is fine soil in some places, the zone is desert. The flora is of the sage-brush type. The fauna consists of animals such as rabbits and lizards.

5. The Tertiary Zone of Loess Terraces occurs within the Paleozoic zone along a belt of soft Tertiary strata. Here at an elevation of from 6,000 to 7,000 feet the valleys broaden and are bordered by low terrace-plains of loess. The interfluves consist of low, rounded hills covered with fine sand and loess; they are too dry to support anything but a meagre desert flora. The terraces are easily irrigated; their long, narrow strips support prosperous villages, the most attractive part of Chinese Turkestan. Most of the staple grains, except rice, grow excellently, as do all the hardier temperate fruits—apples, pears, peaches, apricots, etc., but not grapes or figs. The summer days are hot, but the nights are cool. The winters are cold and bracing, though snow does not remain long.

6. The Piedmont Gravel Zone embraces long slopes, which descend a thousand feet from the lower edge of the Tertiary Zone. The soil is poor and there is no water. The zone is absolutely desert, almost devoid of life.

7. The Oasis Zone follows the gravel slope as it gradually gives place to a plain of fine alluvial material which seems to be identical in composition with the loess of the mountains. Here the mountain streams divide into distributaries which are easily led to all parts of the smooth plain. All the conditions are highly favourable to life. Most of the population of the Tarim basin and all the large cities are located in the oasis zone. The crops consist of those of the Tertiary zone, with the addition of rice, cotton, grapes, etc.

8. The Swamp or Winter Pasture Zone lies farther forward in the basin. During the summer flood season a large amount of water runs past the oases, forming extensive swamps. Here poplars, reeds, tamarisks, rushes, and coarse grass furnish the people of the oases with fuel and with abundant winter pasture for their flocks. Because of the varying size of the rivers the swamp zone departs widely from the concentric or belted form which is so characteristic of the other zones.

9. The Sandy Desert Zone lies beyond the swamps; it is the Takla Makan, the great lifeless sand desert which forms the kernel of the Tarim basin. On its edges fingers of sand extend outward between the swamps. In many places the swamps and the sand are intimately commingled. The latter is gaining ground at the expense of the former, as appears from the belt of dead and dying poplars which stretches for many miles into the sand. Apparently here, as in many other cases, we have the record of a recent change of climate.

All of the nine zones of the Tarim basin show typical desert features. Three of the zones—namely the Granite Mountain, the Piedmont Gravel, and the Sandy Desert—consist of unmitigated desert, in which human life cannot possibly find support. Another zone, the Plateau, varies from unmitigated desert, where it is most elevated, to prolific pasture lands, where it falls to a height of ten or twelve thousand feet. A fifth zone, the Paleozoic Mountain, is almost entirely desert, although in an occasional broadening of a valley bottom one or two families find sustenance. The four remaining zones—namely the Mountain Pasture, Tertiary, Oasis and Swamp Zones—all support vegetation, and hence are adapted to human life. Yet in even the best of them, the Oasis Zone, the habitable area is probably less than a tenth of the total.

It is noticeable that each of the four habitable zones is characterized by deposits of fine yellowish material or loess, partly of æolian and partly of aqueous origin. This loess is still in process of deposition, which takes place as follows: Four days out of five the air over both mountains and plain is filled with a thick yellow dust haze. In the mornings the air is quiet or is lightly stirred by a south wind. Whirlwinds occur by the thousand—one can often count twenty or twenty-five at a time—and great quantities of dust are wafted upward. At noon the wind shifts toward the north and increases in strength. By the end of the afternoon it has reached the northeast and is blowing hard. The dust in the upper air is carried many miles toward the mountains, while coarser particles—

that is, the finest grains of sand—are picked up and carried to the foothills. On reaching the high mountains and also everywhere at night the force of the wind decreases, and the dust and sand fall to the ground. In the high mountains the deposition of dust is aided by the frequent showers which fall in the afternoon or evening. The showers are too light to cause much run-off and erosion. They suffice, however, to cause a thick growth of grass, and the grass retains practically all the dust which falls upon it. Thus thick deposits of æolian loess are still in process of formation in the Mountain Pasture Zone. Lower down much of the dust is washed away, because of the absence of vegetation. It goes down the streams to form the terraces and the alluvial plain. Much of it is doubtless picked up again by the wind and returned to the mountains, so that there is a genuine circulation of loess-making material. Dissected deposits of loess in the Paleozoic (and Tertiary) Zones show that probably during glacial epochs the pasture zone of grass was wider than now, although the sandy desert was then as lifeless as to-day, except where the Swamp Zone encroached farther upon it.

Apparently the requisite conditions for the deposition of loess are—(1) a gathering-ground free from vegetation and exposed to strong winds; (2) a prevailing strong wind in one (or two) directions; and (3) a depositing-ground where the wind is checked and where there is sufficient vegetation to hold the falling dust. The gathering-ground, I suppose, may be either a desert, a floodplain, a seashore, a playa, a moraine, or any place where the wind can pick up sufficient fine dust. The depositing-ground may be high mountains or low hills, but it is not likely to be a plain.

TAM EGHIL, CHINESE TURKESTAN, 13 Sept., 1905.

The occurrence of geographical zones around the Tarim basin, mentioned in my last letter, appears to obtain in a general way for a thousand miles east and west and for nearly five hundred miles north and south. The zones are developed most fully and typically along the south-western border in the two hundred miles from Khotan to Yarkand. To the west and north in the Tian Shan region, as I saw it in 1903 when travelling there for the Pumpelly-Carnegie Expedition, the mountains decrease in height and the upper pasture zone expands at the expense of the more rugged zone of naked peaks and snow fields. The Terrace Zone, on the other hand, dwindles there, because the winds, being prevailingly from northern quarters, carry little or no loess to that side of the basin;

hence, there the terraces consist largely of coarse gravel. Moreover, the warping by which the Tian Shan plateau was uplifted has produced a stronger slope than that which leads up to the Pamirs and western Kuen Lun. Hence the northern streams, being shorter and more torrential than those on the south, have less opportunity to form terraces.

East of the two hundred miles where the zones are best developed they diminish in another fashion. The long monocline by which the mountains on the west are reached gives place to a fault. The zone of Paleozoic mountains disappears. A range of rough granite peaks rises abruptly from the Tertiary Zone of gently-sloping, loess-covered hills. At the foot of the pronounced escarpment thus formed the Tertiary hills reach a height of 10,000 feet or more. They are so high and so close to the lofty main range that their upper portions receive abundant summer rains and form the beautiful mountain pasture zone. Lower down, and at a short distance from the mountains, the green pasture slopes merge into rolling hills of sand and loess, between which plains of loess support prosperous terrace villages. Still farther north the gravel zone, like a huge shingle beach from five to twenty miles wide, borders the sea of sand on whose edge lie the oases. Most of the rivers from the mountains disappear in the gravel zone, though they come to light again in the form of springs in the silt or fine sand of the oasis zone.

The main roads follow the habitable zones. The chief road is like a thread along which are strung the oasis beads. A second road connects the villages lying on the loess terraces, and a third lies in the pasture zone at the foot of the escarpment. The latter is known as the "old" or "Kalmuck" road, because it was much more important in former times when Kalmuck nomads wandered over the foothills with their flocks. There are traces of a fourth road lying forty or fifty miles north of the oases, in a zone where there is now nothing but sand, though in the past there seems to have been a series of small oases along it. I am getting some camels preparatory to an attempt to visit one of these old oases, so as to see whether there is any evidence that the mountain rivers once flowed to it.

KERNJA, CHINESE TURKESTAN, 9 Oct., 1905.

During the last three weeks I have been having a most interesting trip with camels into the sand country. Once the guide failed to find the well, and the camels had to go four days without water.

The chief result of the trip is that on a single line, which would be the prolongation of a group of streams from the mountains if they had water enough, there are five abandoned villages, growing successively older as one goes out upon the desert. They were abandoned at approximately the following dates: A. D. 300, 800, 1300 (probably two at this time), and 1841. Nearer the mountains and at the end of one of the streams lies the youngest village, settled in 1841, when the most recent of the other villages was abandoned. The cause of the recent abandonment was the decrease of water supply in the stream. There is a well-known tradition to the effect that the abandonment of the village in 1300 was due to the same cause. It seems probable that the earlier abandonments were due also to failure of water supply. I am going to give further study to this question.

There is strong confirmation to be found in the desert hereabouts of the idea that the cross-bedding of the Colob (Jurassic) sandstone which I saw in southern Utah in 1902 is of æolian origin. I have a photograph of a section of a sand deposit here which might almost pass for a part of the Colob sandstone in the White cliffs in Utah.

PHYSICAL FEATURES OF THE JORDAN VALLEY.

By William Libbey

(Professor Physical Geography, Princeton University).

Abstract; Illustrated.

The physical characteristics of Palestine make it one of the most interesting regions on the globe.

Rising from well-developed coastal plains to a plateau region near the Mediterranean, it reaches its greatest altitude in the north in the Lebanon and Anti-Lebanon chains. These ranges terminate in the south in Mount Hermon; between them is a depressed valley, which is remarkable in many ways but not so famous as its companion rift valley south of Mount Hermon, known as the Jordan Valley.

South of Mount Hermon there seem to be evidences of a transverse break running east and west, along which volcanic masses of lava have been extruded.

The Jordan Valley, or the river itself starting at Banias, its most abundant source, has an elevation of about 600 feet above the sea-level. Passing downward through the marshy Huleh, it reaches a point some 600 feet below sea-level at the Sea of Galilee. The marshes of the Huleh are produced by the rocky barrier above Jisr Benat Yakub; below this place the river becomes a torrent, in strong contrast to the upper part of the stream.

From the Sea of Galilee southward the river passes over a comparatively level valley, into which it has cut a deep meandering trench which is three times as long as the air-line distance, and during this part of its course it has a fall of as many feet to the mile as the average river has inches of descent, the Dead Sea being 1,292 feet below the level of the Mediterranean.

The plateau east of the Jordan has an elevation of 1,200 feet above the sea-level at Banias, and this elevation increases continuously as you travel southward. We passed over the plateau as far as Petra, and at that point found it to have an elevation of 5,700 feet above sea-level, the rocks throughout being Cretaceous limestone.

Petra, the ancient stronghold of Edom, is located in a pocket in the sandstone mass which has been deposited in a large "bay" on the eastern side of this limestone valley edge—3,000 feet below the level of the plateau.

The structure of the sandstone, being wavy throughout, and the character of its component grains indicate that the mass was deposited in shallow, brackish water. The sandstone west of the Jordan, particularly such remnants as are found west and south of the Jebel Usdum, at Zaweirah, and Jericho, and northward nearly to the Sea of Galilee, indicate the extent of the deposit.

Lines drawn along the top of the plateau and the top of this sandstone horizon are parallel.

Would not all the above details lead to the following conclusions: that after the rift valley had been formed it was widened and deepened, then slowly depressed while this mass of sandstone was being deposited, and afterwards the region was elevated during the formation of the present valley?

The flow of the river to the Gulf of Akabah was stopped when the sandstone had been cut through to the harder rock, about ten miles south of Petra in the Arabah Valley; and the elevation continued until this obstruction was nearly 1,000 feet above sea-level.

From this time the obstruction became the watershed, throwing the waters both north and south. All of the points except this latter one, the character of which is well known, were visited, and the elevations tested by many barometrical readings.

OBSERVATIONS ALONG THE FRONT OF THE ROCKY MOUNTAINS IN MONTANA.

By Lawrence Martin.

Abstract.

[The following study was made in September, 1905, along the front, or Lewis, Range between the Great Northern Railway and the International Boundary in connection with a course at Harvard University under Professor W. M. Davis. See Chief Mountain and Browning topographic sheets.]

The front range in northern Montana shows striking differences from the margin of the Rocky Mountains farther south—for instance, in the Front Range of Colorado, where an unroofed anticlinal uplift with granite core and overlapping sediments produces (1) offlying hogbacks, (2) very even front, and (3) streams in narrow cañons. The Lewis Range contrasts with synclinal structure (observable from the railway pass, which is unique in having its divide at the very front of the range on the edge of the plains), and overthrust structure, producing (1) no hogbacks, (2) an embayed front, and (3) streams in wide valleys. The overthrust, worked out by Willis, superimposes indurated Algonkian on weaker Cretaceous, here visible for over seven miles. This hard on soft produces cliffs above and gentle slopes below, the mountains rising 4,000 feet directly from the plains.

The widely-open valleys are embayments four to nine miles broad, and reaching a third of the way through the range, being terminated where the hard Algonkian, descending westward with the syncline, meets the ascending profile of the streams. This fall line is always marked by a cascade, except in the valley of Upper St. Mary Lake, where it is drowned. The embayments are (1) simple (Kennedy Creek valley with one stream), or (2) drained by several streams (notably the Swiftcurrent, Upper St. Mary Lake, and Belly River embayments). They may be due to glaciation, as suggested by Professor Chaney, or modified by the coalescing of single valleys. Between these embayments long spurs extend, and one, Chief Mountain, is cut off behind and rises as a 9,000-foot tower in front of the range, like a stack on the seashore.

Normal stream and subaerial erosion has produced square towers and roof-like ridges in the nearly horizontal strata. Intense glaciation has cut deep troughs, headed by cirques with tarns and small glaciers and with tributaries in hanging valleys.

On the north side of Swiftcurrent and the south side of Upper St. Mary Lake valleys in the discordant tributaries hang at successively lower levels to the westward (*up* the grade of the former trunk glacier), their hang being determined by a hard stratum in the westward-dipping Algonkian and not by the eastward-sloping glacier.

Swiftcurrent, Kennedy Creek, and others do not seem to hang above the valley of their former trunk glacier, that now occupied by the north-flowing St. Mary River, a tributary of the Saskatchewan. They appear to enter at grade, over enormous alluvial fans; but borings in the fan of Swiftcurrent Creek reveal a U-shaped rock valley 200 feet below the present grade, showing that Swiftcurrent (and presumably the others) is in a hanging valley, masked by the fan. These are *buried hanging valleys.*

The Swiftcurrent alluvial fan dams St. Mary Lake, eighteen miles long, and it is also bisected eight miles southward by other alluvial fans, like Lakes Thun and Brienz at Interlaken and the pairs of English lakes, Buttermere and Crummock Water, Bassenthwaite and Derwentwater.

The U. S. Reclamation Service proposes a dam which will raise the level of this lake, drowning the Montana Interlaken. The water will be turned by a twenty-mile canal into Milk River, which flows into Canada, as St. Mary River does, but differs from it in returning again in eastern Montana, so that this water can be used for irrigation nearly 250 miles away from the mountains.

HARVARD UNIVERSITY.

OBSERVATIONS ON GLACIERS AND GLACIATION AT YAKUTAT BAY, ALASKA.

BY RALPH S. TARR (Ithaca, N. Y.) and LAWRENCE MARTIN (Cambridge, Mass.).

Abstract; Illustrated.

[The observations upon which this paper was based were made in the summer of 1905 in connection with a general geological survey of the Yakutat Bay region by a United States Geological Survey party under the direction of the senior author. A grant of money from the American Geographical Society made it possible to add the junior author to the party as special assistant in physiographic and glacial geology. Published by permission of the Director of the United States Geological Survey.]

Yakutat Bay forms the only important break in the straight stretch of coast-line between Cross Sound, just north of Sitka, and Kayak Island. It lies just south of Mt. St. Elias. Starting as a broad, V-shaped bay, known as Yakutat Bay, it changes to a narrow, mountain-walled fiord, called Disenchantment Bay, then turns abruptly in the form of a bent arm, reaching nearly back to the ocean. The portion above the elbow is called Russell Fiord.

The shores of outer Yakutat Bay and of the head of Russell Fiord consist of a low foreland of glacial débris, and on the northwest side of the Bay the great Malaspina Glacier covers the land back of a fringe of glacial deposit. Disenchantment Bay and Russell Fiord occupy great valleys in the foothill section of the St. Elias chain, with mountains rising from 4,000 to 5,000 feet. Back of this, however, rise many lofty peaks reaching from 10,000 to 16,000 feet in elevation.

In the foothill section there are numerous small valley glaciers, and from the more lofty mountains of the St. Elias chain great glaciers descend through the larger valleys. Some of these, notably the glaciers which unite to form the Malaspina Glacier, descend to the fringing foreland. Others descend to the sea. The Turner, Hubbard, and Nunatak Glaciers are all tide-water glaciers, and the Hidden Glacier descends to a delta deposit built by its outwash in a branch of Russell Fiord.

That the entire bay and fiord were formerly occupied by glaciers is proved by three lines of evidence, as follows: (1) The fringing coastal plain or foreland being of morainic character proves the presence of ice beyond the mountain front; (2) moraines high up on the mountain sides, but lower near the sea, demonstrate the former existence of ice at these elevations; (3) the valley walls, both in the main fiords and in the minor valleys, show clear evidence of powerful glacial erosion. This evidence is in the form of well-defined hanging valleys, straight, smooth walls, grooved and terraced rock sides, and irregularly-fractured rock resulting from plucking.

Between the period of maximum advance and the present time there has been a recession and an important re-advance of the ice. This is proved by the presence of extensive gravel deposits along the sides of the fiord, in which are found tree trunks, in some cases in place, proving that at the time of the deposit of these gravels trees grew where now none are growing. The surface of the gravels is sculptured by glacial erosion, and on it is laid down a veneer of morainic deposit, proving ice advance after deposit. That this re-advance of the ice did not last long is proved by the fact that it failed to remove completely the interglacial gravels. That the present stage of recession has not reached as far back as the earlier recession is proved by the fact that several glaciers, notably the Hidden, have their ends resting on these older gravels. It is probable that this re-advance is the one which is reported by Malaspina and Vancouver in 1792 and 1794 respectively, when they found Disenchantment Bay blocked by glaciers. In any event, the recession is of such recent date that vegetation has not yet encroached upon the gravels near the glaciers.

That there was, between 1892 and 1899, a general recession of the glaciers of this region was shown by Gilbert, and our observations prove that this recession has been in progress since 1899 in all of the glaciers studied except two. It was found possible to reoccupy the sites from which photographs were taken by both Russell and Gilbert, and by means of photographs to show the amount of recession. Plane-table maps were also constructed. Of the large glaciers the Nunatak and Hidden show marked recession; but the Turner shows an advance since 1899, and the Hubbard a very distinct advance since that date.

The deposits along the margins of the glaciers present some interesting features. Of these, one of the most important is the evidence of exceedingly slow melting of the débris-covered ice, and the character of the moraines accumulated under these conditions. Most of the glaciers have their lower ends covered for a distance of from one to several miles with rock débris, and oftentimes the exact edge of the ice could not be determined. The Hidden Glacier offered a marked contrast to the others whose ends were on the land in having a complete absence of marginal morainic veneer. Here, however, the wasting end of the ice is covered by a deposit of outwash gravels, forming a perfect outwash plain, which, by the melting out of the ice from beneath, is developing a pitted topography for a distance of over a mile from the visible end of the ice tongue. These deposits along the margin of the glaciers throw some light upon the origin of deposits terminal to ice tongues.

A more complete account of the observations on the glaciers of the Yakutat region will be published in later numbers of the Bulletin.

THE IMPORTANCE OF SUSTAINING A SPECIAL JOURNAL OF GEOPHYSICS IN THE ENGLISH LANGUAGE AS REPRESENTING THE HIGHEST DEVELOPMENT OF PHYSICAL GEOGRAPHY.

By Cleveland Abbe (Washington, D. C.).

Abstract.

Geographers have usually devoted themselves to explorations and studies that relate to the surface of the earth. Humboldt and Ritter expanded our ideas of physical geography so as to include the

comparative inter-relations of all the features of the superficial globe and their bearing on animals and plants and on the development of the human race, including, of course, climatology.

During the present generation geography has been further extended to include the elastic and thermal phenomena of the globe, or dynamic geology, the ocean and its motions, the atmosphere and its motions, magnetic and seismic phenomena, and sometimes vulcanology. Now, these six subdivisions of the study of the earth are simply applications of our knowledge of the actions of forces—that is to say, of energy. They deal with the essential physics of the globe. In Germany the former half of physical geography is *Erdkunde;* this latter is *Geophysik.* The ordinary journals of geography are descriptive and cartographic. The newest tendency is strongly towards the experimental and mathematical treatment of problems that are fundamental to our knowledge of the origin of the earth and the development of its geographic and physical features. The study of this latter subject will be greatly furthered by the establishment of a journal in the English language as devoted to its interests as is the German publication, Gerland's *Beiträge zur Geophysik.* At the present time the literature of the subject is so scattered as to render it difficult to know where to publish a new memoir or where to find an old one.

Dr. L. A. Bauer has found it proper to extend his admirable journal "Terrestrial Magnetism" so as to cover atmospheric electricity and seismology. If now the other closely-allied subjects enumerated above could be included in the scope of this journal then the needs of geophysicists would be satisfied.

THE INFLUENCE OF GEOGRAPHY ON THE EXPLORATION AND SETTLEMENT OF ALASKA.

By Alfred H. Brooks (Washington, D. C.).

Abstract.

This paper presented chiefly the geographic influence on exploration, for the influence on settlement was considered only incidentally. The position of a large percentage of the settlements in the Territory has been determined by the distribution of gold, often in apparent defiance of geography. This, then, is a geologic and not a geographic control of man's habitations.

Man's advance in Alaska has been determined by four geo-

graphic features, namely: (1) Position relative to other land masses, (2) extent of coast-line, (3) intensity of relief, and (4) water-courses. A study of a chart of the world shows the juxtaposition of Alaska and Siberia, their extremities being separated by a strait only 54 miles in width. Of greater importance is the chain of Aleutian Islands which almost bind the two continents together. These offered guide-posts to the inexperienced navigators in their quest for furs who first explored the Alaskan coast, using Siberia as a starting-point.

Alaska being isolated from the rest of the continent, forming as it does a great peninsula thrust out between the Pacific and Arctic drainage, had much to do with its remaining unknown so long after much of the rest of the continent had been explored. Its position, however, made it the natural goal for those navigators who explored the eastern shore of the Pacific.

The extensive coast-line (exceeding 20,000 miles) has made much of this land accessible to the explorer and settler. Along the Pacific seaboard open to navigation throughout the year the many fiords, harbours, and sheltered waterways have done much to make this the first part of the territory to be settled and explored. The Bering Sea and Arctic Ocean littoral, though open to navigation for only part of the year, was also, because of its accessibility from tide-water, among the first provinces to be explored.

The four broad topographic subdivisions of western North American—namely, the Great Plains, the Rocky Mountain System, the Central Plateau region, and the Pacific Mountain System are recognizable throughout Alaska. These geographic features, together with the drainage systems and climatic conditions, have dominated the exploration and settlement of the great inland province embracing over half the area of the Territory. The settlements along the Pacific during and long after the Russian occupation were kept from spreading inland by the snow-clad ranges which skirt the seaboard. The Pacific Mountain System varies from a width of 50 miles in Southeastern Alaska to over 200 miles at the apex of the Gulf of Alaska, then to the southwest narrows down again to less than 20 miles in the Alaska Peninsula. The shortest route from tide-water to the Yukon Basin is through the Coast Range in the Panhandle. This route, long used by the natives, was adopted by the white men over a quarter of a century ago, and was well established when, in 1897, the Klondike excitement carried thousands of gold-seekers across the Chilkoot Pass.

Though several rivers, such as the Copper and the Alsek, traverse the coastal mountains, they are unnavigable, and hence played no important part in determining the routes of approach. The Valley of the Sushitna does, in fact, present a feasible route into the interior; but as this lies in the broadest part of the Pacific Mountain System, it has not yet been extensively used.

The Rocky Mountain System forming the eastern barrier long marked the western limit of exploration from the Atlantic. It was not until Mackenzie had traversed this barrier in 1793 that exploration began from this direction. The Central Plateau region, bounded on either hand by great mountain systems, would be relatively inaccessible were it not for the two great rivers, the Yukon and Kuskokwim, which carry most of its drainage to Bering Sea. The Yukon, the main artery of an extensive drainage system, gives access to much of the vast intermontane region. Its thousands of miles of navigable waterways have long formed the great highways of inland travel, in summer by boat and in winter by dog team. The Kuskokwim River, second in size only to the Yukon, has also afforded routes of travel to the explorer, fur trader, and prospector.

To recapitulate: Alaska's peninsular form and irregular shoreline, with the concomitant extent of coast-line, have given ready access to much of the Territory. Its proximity to Asia determined that the first explorations should be from the west. The almost unbroken series of coastal mountains along the Pacific for a century shut off man from the inland region, and the Rocky Mountain barrier on the east retarded exploration from that direction. On the other hand, the extensive inland waterways of the Yukon and Kuskokwim Rivers afford routes of approach from Bering Sea.

It is impossible within the compass of this paper to summarize the early explorations which, all following routes determined by the above-described geographic features, came from three directions. The Russians, approaching from the west across Siberia and Bering Sea, were the first in the field. Then came the navigators of various nationalities, who reached this region from the south by following the eastern shore of the Pacific. At a much later date the English fur traders, after having traversed the entire continent, came into the Yukon Basin from the east.

Bering, the discoverer of Alaska, made his first voyage in 1728, but did not make a landing on the coast until his third voyage, when he reached Kayak Island, and sighted and named Mt. St. Elias. Chirikof, about the same time, attempted a landing near Cross Sound, but was repulsed by the natives.

The return of the survivors of Bering's crew brought the news of a new fur-bearing region, and the succeeding half century witnessed the gradual encroachment of the Siberian traders from the west along the Aleutian Islands. In 1778, Capt. James Cook began that brilliant series of explorations by English naval officers which continued for over half a century, and to which we owe much of our knowledge of Alaska's shore-line. Spanish voyagers also made some coastal explorations. The most important work of the Russians was the exploration of the lower courses of the Yukon and Kuskokwim Rivers. The English fur traders reached and explored the upper Yukon in 1848. In 1866 this work was extended by the explorers of the Western Union Telegraph Co. The later explorations are not here dwelt upon because geographic features have had less control in determining the routes of travel.

SOME RESULTS FROM THE DRIFT CASK EXPERIMENT IN THE ARCTIC OCEAN.

BY HENRY G. BRYANT (President of the Geographical Society of Philadelphia.).

With the view of securing data in relation to the speed and direction of Arctic currents or "drifts," believed to run from the vicinity of Bering Strait north and northwestward across the polar area, some fifty spindle-shaped oaken casks, of twenty-gallon capacity, were constructed in 1898 from designs submitted by Admiral Melville and placed on board a number of steam whalers sailing north from San Francisco, The U. S. Revenue Cutter *Bear* also distributed fifteen of the casks in 1901, while on her annual cruise to Point Barrow. Each cask was numbered and provided with a message printed in four languages, which was inserted in a sealed bottle, which, in turn, was enclosed in a wooden case, before being placed in the cask. The instructions which accompanied each consignment of casks directed the masters of the vessels engaged in the work, before placing the casks adrift, to fill in, in the spaces provided on the message paper, the name of vessel and master, number of cask, the date and the latitude and longitude where cask was placed on the floe ice. The assisting captains subsequently reported to the Society the various positions where casks had been launched, and these data were duly tabulated. Reports of the launching of some thirty-five of the casks were received in this way.

The message paper, consisting of a waterproof linoleum substance, requested the finder to fill in, in the space provided, his name, date, and latitude and longitude of locality where cask was recovered. The finder was further requested to forward the recovered message to the Geographical Society of Philadelphia.

It was estimated that from three to five years would elapse before any of these messages would be heard from. The promoters of the experiment were gratified when two of the messages were received in Philadelphia in the latter part of October, 1905. An examination of the first record shows that it was cast adrift by Capt. F. Tuttle, of the U. S. Rev. C. *Bear,* on August 21, 1901, about 85 miles N.W. of Wrangel Island, and recovered by Capt. A. G. Christianson on August 17, 1902, near the mouth of Kolyuching Bay, on the Siberian coast. It is evident that this particular cask did not get a good start, and in the one year less four days of its drift the course it followed of 380 miles to the southeast was probably influenced by local currents which exist near Bering Strait.

The other representative of this silent fleet which has been traversing the desolate wastes of the Arctic Seas had a longer voyage, and, doubtless, a more eventful history. Placed on the floe ice northwest of Point Barrow, Alaska, in Lat. 71° 53′ N. and Long. 164° 50′ W., by Capt. B. T. Tilton, of the steam whaler *Alexander* on September 13, 1899, it was recovered one mile east of Cape Rauda Nupr, on the northern coast of Iceland, on June 7, 1905. There can be little doubt that this cask was transported by that slow but persistent current which, starting in the Arctic Sea north of Bering Strait, and aided, perhaps, by the rotary motion of the earth, moves in a northwesterly direction along the Siberian coast, passing to the north of the New Siberian Islands, and, aided by the warm discharges from the Siberian rivers, gains in volume and speed and sweeps around and across the Polar Sea north of Franz Josef Land, emptying into the sea between Greenland and Spitzbergen, and thus eventually reaching the North Atlantic. The drift-cask experiment was undertaken to secure data to prove the existence of just such a current, and the safe arrival of one of the flotilla by the prescribed route is a source of satisfaction to the promoters of the enterprise.

Assuming that the cask followed the most direct route in its journey, I estimate that it travelled about 2,500 miles in the five years eight months and twenty-five days which elapsed. If, however, as is more probable, it followed the more circuitous routes heretofore taken in the drift of the *Jeannette* and *Fram,* the entire distance traversed from Point Barrow to Iceland would be fully 3,000 nautical miles. In view of the fact that, thus far, but one cask has made the journey and that over five years were occupied in transit, some may question the value of the results obtained. In answer to this view of the question, it may be well to remember that doubtless other casks will be reported from time to time; and, in this connection, we should not forget the vast extent of the Arctic Ocean, which comprises an estimated area of between four and five millions of square miles, and presents difficulties of navigation not comparable to those of the temperate zone. The remoteness of the region traversed by these casks must also be considered; and it must also be remembered that, even when brought by the great elemental forces mentioned to their journey's end, they are even then in regions far from the haunts of civilized men. All these circumstances render the recovery of these messages, at best, a piece of rare good fortune.

POLITICAL GEOGRAPHY AS A UNIVERSITY SUBJECT.

By Emory R. Johnson (Philadelphia).

Physical geography has long been taught in many colleges and universities, and for some years commercial and economic geography has had a place in the curricula of such institutions. Political geography, however, has not yet been generally introduced into college and university courses. Whether the subject ought to be introduced or not depends upon its content, educational value, and relation to other courses of study.

Political geography may be defined in general terms to be geography in relation to political and social institutions. This definition contrasts political geography sharply with commercial and economic geography, which is concerned with geography as related to economic activities.

The study of political geography was introduced at the University of Pennsylvania in the autumn of 1904, primarily for the purpose of enriching the study of the political and social sciences. Experience has shown that students enter the University of Pennsylvania—and the conditions at other universities are doubtless the same—almost entirely ignorant even of elementary geography. To teach economic subjects, sociology and government, not to mention other university subjects, a knowledge of "old-fashioned" elementary geography is necessary. Of course the students need something more than elementary geography as a preparation for the satisfactory study of government and the different branches of economics, and the course in political geography at the University of Pennsylvania has been made advanced in character, without, however, neglecting the study of general and descriptive geography.

The fact that political geography was also thought to be a study of much cultural value was another reason for introducing it into the curriculum of the university. The course as now being given is intended primarily for freshmen in the Wharton School of Finance and Commerce, but is open to election both by the upper classmen in the Wharton School and by college students generally. Several college students outside of the Wharton School have elected the course.

The scope of the subject as taught has been influenced by Mill's International Geography, which is used as a text-book. The text book, however, is not closely followed, and the instructor feels free to put into the course whatever facts of political geography that seem to him important; the course is purposely made somewhat unsystematic, the primary object of the instructor being to inspire the students to study geography not only in books but in the daily press. The instructor believes that the most important service he can perform is to awaken a keen interest on the part of the students in the affairs of the world and to influence them to acquire the habit of using an atlas and a gazetteer.

The methods followed in giving instruction have purposely been developed with reference to causing the students to learn the main facts of ordinary geography. No attempt is made to avoid the study of things that are elementary, but emphasis is laid (*a*) upon an explanation of how each country studied came to be a separate, distinct country; (*b*) upon its political institutions and the geographic influences that have affected them, and (*c*) upon the present political problems of paramount interest in connection with each of the countries studied.

The world-events of the past two years have greatly assisted in making the course interesting. This year while the class was studying Great Britain, the Irish question was agitating British politics; in the study of France, the great question of separation of Church and State came up for discussion; the interest of the class in Norway and Sweden was enhanced by the events that have led to the separation of Norway from Sweden; the Balkan Question has been at the forefront for a few months past; for two years the great Russo-Japanese war has made the study of Russia and Japan of especial interest; likewise the South African war is still a recent event in the history of the world, as is also our recent war with Spain. Light can be thrown upon these and many other questions of world-politics by studying the geographic factors affecting them. The interest of the student in reading the papers can be greatly enhanced by this kind of political geography.

While it is still too early to state definitely the results of the study of political geography at the University of Pennsylvania, there is every reason to feel that the course is succeeding. The students seem to appreciate the subject, and the success thus far attending the course seems to warrant the continuance and development of the work.

THE PLACE OF ECONOMIC GEOGRAPHY IN EDUCATION.

BY J. RUSSELL SMITH, Ph.D. (Wharton School, University of Pa., Phila.).

The phases of geography are many, and they are all interesting, but, thus far, education, particularly higher education, has neglected to recognize the fact that all human activity is run out in a geographic mould.

Earth form, earth structure, earth history, climate, and the biologic response are interesting, as are all sciences, but the bearings of these upon human welfare and activity may reasonably be expected to be of interest and use to a greater number.

As a negative pedagogical example of this, I remember a geography lesson in a German gymnasium that I visited a few years ago. It was in Leipzig. The instructor was a Doctor of Philosophy, a student of Kirchhoff and the great Ratzel, and the son of a geographer of some note. So great was the concentration of study on the Vaterland that the part of the lesson that pertained to North America was the second and last reference to that continent that came in the entire course in a classic gymnasium. In a hasty review, indicative of previous drill, the instructor had the students name the Great Lakes, Hudson's Bay, and various uninhabited lands and unnavigable waters lying to the northwestward, and then he launched into a long and vivid account of the Greenland ice-cap and Peary's recent exploits and explorations.

So far as the course of instruction was concerned, the members of that class left that gymnasium in ignorance of the fact that Canada is a veritable empire and that the United States was a world-power and had furnished comfortable homes for more Germans than lived in their kingdom of Saxony. That lesson certainly does not represent the present tendency in American geography-teaching.

Herbert Spencer's theory of education is steadily gaining ground. For the average modern man and for the school of the future, the most fundamentally interesting thing about the geography of any land should be its suitability as a home for man. The ability to see an economic situation is often surprising by its absence, but an increasing recognition of economic factors is evident in education, in current literature and in the present interpretation of history and society. The study of the earth as a home for man has all the charm of any scientific inquiry and the other vitalizing touch of human interest. It does not involve the laying aside of any of the educational work now done. It is an extension and an application rather than a replacement. The physical geographies need to stand and be much more thoroughly taught. It may properly be said that factors other than strictly geographic affect the usefulness of a land for man. In this matter of definition, I must borrow the freedom of the writers of commercial geographies who bring into their books the discussion of products arising from geological or geographical influences alike, if they result in commercial commodities.

As I see economic geography to-day, it is the interpretation of lands in terms expressive of usefulness to man. It involves (recognized or unrecognized) the creation and use of a definition of the environment necessary for the support and development of a civilized or an uncivilized community. The student must, therefore, be as familiar with human activity as with geography. Is a region good for agriculture? To answer this the geographer must understand agriculture in its broader and its particular aspects. Is a region adapted to become a manufacturing centre? This question can only be answered rationally in the light of knowledge of the facts and laws of industry, of commerce, and the characteristics of peoples.

If this study is not held very close indeed to the goal of human usefulness, it is almost sure to become warped and twisted by some one's instincts for scientific classification. For example, it is difficult for a writer or teacher to distribute emphasis equally among ten small states and one large one which is their equal in all other respects. On this basis the United States suffers in comparison with Europe, and Texas in comparison with New England. In the text-books distant continents are prone to become small and of uniform consistency and importance. They all look alike on the map and the maps are always small. The statement or the description of the products of one political division after another is apt to be deadening and bewildering. The study of commodities has the danger of running away into classifications which destroy emphasis and render it impossible for any but the most mature to grasp the fundamental economic importance of some things and the fourth-rate and incidental bearing of others upon the vital question—the maintenance of human society.

Economic geography is not a modification of geography, the science of the earth, or of economics, the science of wealth. It is not a mixture composed of scraps or pieces of each. It is an alloy, produced by the fusion of the two into a harmonious study, with a view-point of its own, the economic interpretation of lands, the definition, the quality, and the distribution of the environment for human communities.

In economic geography, resources become almost as important as products, because the resources of to-day make the industry of to-morrow. In the recognition, explanation, and proper estimate of resources lies the kernel of economic geography. Economic progress depends upon the better utilization of the resource now in use and upon using to-morrow something which becomes a resource through to-day's discovery.

The best statesmen and business men must alike foresee and prepare for future developments. Economic geography is the part of education to point the way to this future and equip the citizen to take advantage of it. He cannot be equipped to foresee all changes, but he can be equipped to see the general trend and be prepared to keep himself informed if need be.

The phenomenal material development of the United States since the Civil War is often attributed to the fact that some four million men were marched around over the country and became acquainted with its resources. This learning was accompanied by the killing of nearly a million of the men and the wasting of billions of treasure. Cannot the geographies of this day teach the rising generation more easily and economically?

The science of economics, dealing with wealth, is a shaft without a pedestal unless there is first acquired the understanding of the primary conditions of production that is to be obtained by a study of economic geography. As economics is now becoming a part of most college courses, there is required for its proper background and its proper comprehension a previous study of economic geography.

THE ORGANIZATION OF SCHOOL GEOGRAPHY.

By Richard E. Dodge (New York).

The organization of geography for elementary schools so that it will be strong educationally and geographically is one of the most difficult problems that confront a worker in educational geography.

The possible scope of the work is as comprehensive as the science of geography itself. Hence the necessity of choosing such topics and facts as will be of most value to the youthful students and give them the best training in the subject and in the ways of studying geography. The work must be arranged year by year so as to be within the scope of the pupils' mental abilities, and must be of such a character that a pupil will have gained something of permanent usefulness no matter at what time he leaves school.

Just as in a well-ordered chapter in expositional writing each paragraph must be based on the preceding paragraphs and lead up to the succeeding paragraphs, so the work throughout the grades must be based on that which has gone before and lay a foundation for that which is coming. While the work of the course as a whole must be a unit, each year's work must also be a unit, as, indeed, must each lesson.

The task of the organizer of a school course in geography, therefore, is—first, to decide what pupils should gain from their school work in geography; second, to see that this work is good geography at every step, so that it will be approved by geographers; third, to arrange the work so that it is strong educationally; fourth, to bear in mind that regional geography must be taught early, because so many pupils leave school at the end of the fifth or sixth year; fifth, to see that the best training in the methods of studying geography is given in each year; and sixth, that the work of any grade must not be overturned in later years.

This applies particularly to generalizations and definitions. A definition must *define*, and must be a summary of the points previously presented on a special topic. It must be of such a character that it can be built upon as the years go on without any necessity of relaying the foundation gained in the earlier years of work.

Good geography and good teaching demand that the work should proceed from the near and familiar to the remote and unfamiliar; that certain of the continents should be studied twice, but from different points of view; that training be given in the reasons for things at every step; that the work in the higher grades should be from causes to consequences; that enough knowledge of facts be given to make the general principles clear and have pupils sufficiently acquainted with places in the world to be able to understand current events, and that pupils should know how to gain more knowledge of geography as the years go on after they leave school.

Courses of geography arranged to exploit a certain method of teaching are not as strong geographically or educationally as courses arranged to give the best training in the science, the method to be employed in teaching changing according to the mental nature of the pupils.

It is, therefore, the task of the scientific geographer to organize the work as a whole, so that it will give the best training in the subject and the methods of teaching the subject, for no one can outline the scope of school geography unless he sees clearly the part that school geography should play in laying a foundation for further study of the subject in the higher institutions or private life. It is the task of the superintendent or supervisor, within the limits set by the geographer, to arrange the work so as to be best adapted to the pupils' abilities and best related to other subjects in the curriculum. It is the business of the teacher of any grade to have her work in geography based on the previous work, and lay the best foundation for the next higher year's work, while she adopts a method of teaching that will give her pupils the best training in methods of study. The teacher must remember that she is teaching children, and that geography is but one of the many subjects involved in their training. A teacher who has in mind simply the science may fail to give her pupils the best training possible, while one who has in mind merely the principles and methods of modern education may not give sufficient attention to the subject as a subject.

SOME REMARKS ON THE USE OF TOPOGRAPHIC MAPS IN THE SCHOOLS.

By Martha Krug Genthe (Hartford, Conn.).

*Abstract.**

It is desirable that the use of the topographic maps should be taught in the elementary schools, because a great proportion of the pupils never get more than an elementary school education. The best time for the work is the last school year, because then the map work can be utilized to review, from new points of view, the substance of the earlier studies, and also because it must be preceded by the more elementary forms of cartographic representation in the course, which must prepare the way for this most scientific cartography.

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* The substance of this paper having been published in full before (Jour. of Geogr., May-June, 1905), only an abstract is given here.

The stages of preparation are (*a*) the study of topographic features in nature and their reproduction in the sand pan; (*b*) the study of "relief" maps (see Frye's geographies) as pictures of such sand models, showing *where* things are, instead of the things *themselves;* (*c*) the study of school maps on the international colour scheme (see the "Natural," and Dodge's, geographies). By colouring an actual relief in different shades corresponding to the heights, and transferring the colours to a "relief" map, the transition from the pictorial expression of the latter to the more conventional of the new stage can be easily made without overtaxing the child's power of abstraction.

Children who are familiar with the international colour scheme can be introduced into the understanding of the contour map with little difficulty if at the first presentation of the latter (for which the home sheet ought to be selected) the contours on the same appear coloured, so as to present a difference of *grade* only, not of principle, in comparison with the maps to which the child has been accustomed. The child then sees the same kind of map as before, only more differentiated, and must learn to read from the ten or twenty shades of the coloured contour map the elevations above sea-level as easily as he has done before from the five or six shades of his text-book map. Then the idea of showing only the *boundaries* of the areas of equal height must be brought before him, and a reproduction of the same map presented which shows only those contours that had been used as colour limits (each 100 ft., or even 200 ft., according to the relief or scale of the demonstration sheet). After the contour idea has thus been established in the child's mind, the possibility of a more detailed application of the same can be suggested, and thereupon the real contour sheet is presented.

After this, exercises in the practical use of the map must be made; measuring of distances, and calculating the time it would take to walk, or to ride, over them, and letting the child compare the result of the calculation with actual experiences; drawing the outlines of hills and mountains from the contours in the shape of sections, by transferring on paper both distance and elevation, on the scale of the map. It may be necessary at first to use the tenfold elevation, since on the 1 mile=1 inch scale 250 contours would have to be crowded on the space of a vertical inch, and no more than 25 can be accommodated there with any chance of accuracy; but in this way the child will learn how much we must abstract of the heights of most mountain profiles, and part of the section, if not all, must then be enlarged either to the 10 inches=1 mile size of the vertical scale, or, perhaps, the latter reduced and the horizontal scale enlarged to an intermediate 5 inches=1 mile scale. Arithmetics can here co-operate very well with geography. Finally, a model made from cardboard of which no more than 25 sheets make a vertical inch, by cutting out each contour interval along the contour line and pasting the slices of cardboard on each other representing the different layers, so to speak, of elevation, will produce a plastic model of a mountain, not too much overheightened, which will demonstrate to perfection the relation of contour to elevation. Seen from above, it looks exactly like the corresponding part of the contour map, and the child can see that steep slopes appear as a crowding of contours, that contours wide apart correspond to gentle ones, that valleys coincide with lobe-shaped parallel contours, etc. The study of the home sheet thus accomplished, other sheets whose objects may not be familiar to the children are taken up and interpreted by them.

Where no sheet of the home district is available, the contour map of the United States published by the Geological Survey, which is published both coloured and uncoloured, may be chosen for the first exercises, and the later ones done on any other characteristic sheet with well-defined topographic features.

Information on the work of the U. S. Geological Survey and how to obtain its publications should conclude this course.

MAP STUDIES FOR ENGINEERING STUDENTS.

By Douglas Wilson Johnson (Boston).

Abstract.

This paper presented an account of certain methods employed in giving instruction to engineering students in the subject of physiography. The object of the work, as stated, is to make the engineers so familiar with the different land-forms and their origin, and their representation by contours, that whenever they see a contour map it will have the fullest possible significance to them; whenever they use a contour map they will know at sight with what special types of hills, valleys, etc., they are dealing; and whenever they make a contour map they will work intelligently, producing an expressive, well-proportioned, significant representation of the earth's surface.

To accomplish this object, three things are essential: (1) The student must know the appearance of land-forms as we find them in nature, so as to be able to recognize them readily. (2) He must know the appearance of the contour representations of those same forms as we find them upon the map, so as to be able to recognize them there and to reproduce them on maps of his own. (3) He must understand the origin of those forms, the history of their evolution, their past and future changes; for only thus can he fully appreciate their significance.

To familiarize the student with the appearance of land-forms in nature, field excursions are taken, which also afford an opportunity for the correlation of a number of topographic features with their contour representations. In this way the student gets a first-hand acquaintance with a certain number of forms, and learns to read contours to the extent that he acquires the means of obtaining a second-hand acquaintance with other forms which he cannot visit in the field.

The use of photographs and lantern-slides aids the student in broadening his acquaintance with the features of the earth's surface. The correlation of the actual appearance of these features and their representation by contours being of prime importance, it is found important to mount photographs of typical land-forms, together with contour maps of those same forms, in frames, which may hang upon the walls of laboratory and lecture-room. On the lantern-slide both the photograph and map may be shown together, so that one is able to compare the photographic and contour representations of the same feature at a glance.

A most important part of the work consists in the detailed study of a large number of maps representing the more important topographic features of our country. For this purpose over three thousand of the U. S. Geological Survey's contour maps, mounted on cloth, were classified according to the features represented by each, a sufficient number of duplicate sets being furnished to supply a laboratory section of convenient size. After studying these maps to learn the characteristic features of each, the student is required to draw ideal contour maps representing the essential elements of a stated number of the more important forms. In the lectures which accompany the laboratory work, the questions of origin, development, and classification of land-forms are considered.

COMMERCIAL GEOGRAPHY FOR SECONDARY SCHOOLS.

By J. PAUL GOODE (Chicago).

Abstract.

Commercial geography, one of the youngest claimants for attention in the school curriculum, is a great field, widely recognized, but in this country essentially unorganized. In the subject as we have it presented there are two well-defined points of view—the commodity and the country. Difficulties begin in trying to limit the field, to determine what *is* the geography of commodities. The question raised as to processes; they have a right to enter, if they have a geographic bearing—for example, the ring spinning machine, in its relation to the rise of cotton manufacture in the lands where the cotton is produced.

For secondary schools the practice is challenged of trying to cover the earth twice; from the point of view of commerce, and also from the point of view of the country, the country as the unit in elementary work being illogical—for commerce in inter-regional—and the conditions of production and transportation are mostly physiographic. We are attempting to do too much in a year. It would be much wiser to leave the country as the unit of treatment to advance study, and make the elementary course deal with commerce and commodities. An analysis of such a course offered. For the presentation, the prime requisites of the teacher looked into, also the character of the text-book. The current school text criticised as too condensed, with a tendency to compilation of unrelated statistics, and to a lack of real geography.

The value of the study emphasized, as compelling research and the use of the library; and especial attention called to the value of our Government publications. The great value in class demonstration of maps and graphs, as also the significance of the lantern, particularly in the study of maps. The significance of the museum as auxiliary to library and class-room, and the good work of the Philadelphia Commercial Museum along this line. The excursion to mine and factory considered as an instrument of instruction.

HOME GEOGRAPHY.

By F. P. GULLIVER (Norwich, Conn.).

It is now pretty well agreed among educators that the study of geography should be commenced by obtaining a clear understanding of the local surroundings of the school. From a careful study of the home region, pupils may be led in ever-widening circles to a rational conception of the whole world. It is impossible, of course, for each pupil to observe many of the facts of geography which an educated man should know. A few more favoured pupils will have travelled several hundred miles, and will thus have been able to observe the geography of a city, a village, and the country, and they may easily be led to compare the conditions in which men live in contrasting localities.

The great mass of pupils, however, seldom go far from their own homes. It is a well-known fact that there are many children living in New York City who have never seen the elevated railroad, and there are many grown people in country districts in the United States who think that you are telling them some fairy tale when you describe the conditions in New York which have led to the building of a railroad above the level of the streets. There is no doubt that a great many statements in our ordinary geographies are worse than myths and fairy tales to many pupils who read the books, and even to some of the teachers who are trying to teach them.

The most scientific method of beginning the subject of geography is to observe with the pupils their immediate surroundings, and, after studying these, to lead their minds to a rational comprehension of the facts of other parts of the world. Through a study of the school grounds, the streets, the highways, the railroads, and the steamship lines leading out from the home the pupils may be made to realize something of the relative size, position, and importance of other cities in distant countries in the world at large.

Maps of the schoolroom, the school grounds, and the home city or village should be constructed by the pupils before maps of more distant regions are shown. Only after pupils fully realize that a map means some definite portion of the surface of the earth, which may be seen and passed over by man, can they wisely study and intelligently comprehend maps of other parts of the world.

A study of the local plants and animals will lead to a rational understanding of plants and animals in their relation to man. It is not necessary that an exhaustive study should be made of all the plants and animals which surround any school, but by a wise selection of certain plants and animals, to be studied minutely, the pupils may be led to understand later the larger facts of life which are of such importance in the distribution of man on the face of the earth. A large proportion of the facts learned in regard to life histories of local plants and animals are true in regard to plants and animals living in more distant parts of the world. Therefore, the study of the plants and animals near the school is an important part of the early training in geography.

Accurate observation is the most important fundamental principle in scientific training, and there is probably nothing better than this study of plants and animals to teach pupils how to observe. Much of the time spent in the observation of nature might be made more valuable as a part of the geographic training of early years. By a comparison of local plants and animals with those of more distant regions, the facts which the pupils know from their own personal observation may be used to increase their knowledge and understanding of the larger geographic relations of living forms.

The first introduction of the pupil to history belongs also with the study of home geography. The facts controlling the physiographic location of settlement, and the development of cities in favourable locations are closely interwoven with the local history. Therefore a brief study of the historical development is a fundamental part of home geography.

By detailed studies of the home productions and industries, pupils may be led to understand the great facts which control the business and commerce of the world. When a few mills, stores, mines, etc., have been studied in detail, and the facts in regard to them made part of the students' personal knowledge, the facts in regard to other regions are more clearly comprehended by a comparative study of the home products with those of other regions. Thus interrelations of men in the country and the city, in the mountains and on the plain, on land and on sea, are made clear to the minds of pupils.

From a study of the shipping of some agricultural product or manufactured article the great facts in regard to transportation are easily understood. Thus study of lines of commerce may take the place of actual journeys, and, by following on maps these routes along which shipments of local products take place, the pupil will be led to a knowledge of the surrounding country, and finally of more distant parts of the world.

PRACTICAL EXERCISES IN PHYSICAL GEOGRAPHY.

By Philip S. Smith (Cambridge, Mass.).

Abstract.

In order to make laboratory work disciplinary and instructive, it is evident that exercises should be specific. To give this quality, it is necessary that all students should be working on the same material at the same time. It is desirable that all extraneous matter should be eliminated, so that the student's attention will focus on the fundamental features. The Government maps, excellent as many of them are, present such a wealth of detail that the characteristic forms are often masked.

It is the duty of the modern physiographer not only to describe the character of individual land-forms, but also to determine their relation to the series in which they belong. Therefore, maps for laboratory work should show the same region at different stages of development.

Owing to the fact that large-scale maps do not bring out the essential characteristics and do not show successive stages of development, it has seemed advisable to prepare diagrammatic maps and sketches. In conducting an exercise with these diagrams, the student is given three sheets. The first, completed by the instructor, shows a land-form in different stages of development. The second sheet shows the same type of land-form as the first, but has the various topographic features differently distributed and the critical points left blank. The third sheet contains any instructions that are necessary, and also questions referring to the maps on Sheets I and II. The exercise consists in studying the completed figures, answering the questions, and filling in the blank spaces on Sheet II.

After a student has completed one of these exercises he is then ready to study topographic maps of the same kind of land-form, for he has a type to which the variations and similarities of the actual field examples may be referred for comparison.

The use of diagrammatic maps for laboratory work seems to have the following advantages over the older method of using only large-scale topographic maps:

It omits unessential details.

It obviates mere mechanical copying.

It trains the student both in verbal and graphic description.

It holds the student's attention closely, for it increases the specific quality of the questions.

It stimulates the consideration and application of physiographic principles.

THE PRESENT CONDITION IN OUR SCHOOLS AND COLLEGES OF THE STUDY OF CLIMATOLOGY AS A BRANCH OF GEOGRAPHY AND OF METEOROLOGY AS A BRANCH OF GEOPHYSICS.

By Cleveland Abbe (Washington, D. C.).

Ever since the beginning of the publication of the daily weather bulletin of the Cincinnati Observatory I have not failed to urge that meteorology be taught in our schools, colleges, and universities as a department of knowledge of importance to every one, as tending to dissipate superstitious ignorance, and as stimulating the interest of those who may have a slight natural tendency to devote themselves to the advancement of this difficult study.

At that date Loomis's text-book was used in a few colleges; in others some remarks on meteorological phenomena were made in connection with text-books on chemistry, physics, astronomy, and physical geography. In fact, the sciences were not taught then as they are now. It was in 1882 that I gave the students of our Normal School in Washington some talks on methods of teaching meteorology as a part of nature-study, and prepared a form for the use of the pupils of the lower classes of the graded schools, who should keep their own daily weather records and discuss them in a popular, logical way. The principal of that Normal School, Miss Lucilla E. Smith, subsequently carried the same idea to the teachers' Training School of Brooklyn, where it has not ceased to bring forth good fruit. But the great pioneer in school and college work was our colleague Prof. W. M. Davis, who made his elective courses for the freshman class of Harvard so thorough and so attractive that they became the ideal model for all others. The influence of the Harvard school of meteorology has been felt everywhere, especially, of course, where its graduates have established other centres of instruction.

Although the officials of the U. S. Weather Bureau have but little time or opportunity to devote to teaching, yet they have improved every occasion to promote this good work, as being the best method of securing an intelligent popular appreciation of the great problems of weather prediction. Some of us have been able to give lectures of a very technical character for the benefit of the most advanced students, but most of us have gone to the smaller colleges and to private and public schools, where we could reach the mass of the people; here we have explained the weather map and the work of the Weather Bureau.

The reports from our stations show that during the past year work of this kind has been done by about 100 of our observers, section directors, forecasters, and professors, showing that to this extent the interest in the subject is quite uniformly distributed throughout the United States. All wish to know something about the subject. At almost every Weather Bureau Station many lectures or talks were given during the year. In fact, in each locality many schools and colleges are studying the subject, and the lectures by our observers merely constitute small incidents in the courses of instruction.

We are making a fairly complete collection of statistical data relative to the present state of meteorological instruction, and, so far as at present heard from, an estimate may be made which will give us the following general results:

About 1,000 *graded schools* teach the elements of climatology as a part of geography, receive the daily weather maps, and give talks upon their use in forecasting the weather. About 7,000 *high schools*, or seven-eighths of the whole number, teach the elements of meteorology and climatology in connection with physical geography or physical geology.

The replies to a circular letter recently sent to 177 public normal schools in the United States indicate that in about 25 meteorology and climatology are taught in specific courses, in about 115 these subjects are taught in connection with physical geography or some other allied subject, and in the remaining 37 these subjects are not touched upon.

As to colleges and universities, out of 245 replies 49 state that they have specific courses in meteorology, 95 teach meteorology in connection with some other subjects, and 101 pay no attention to the subject. The corresponding percentages are 20, 39, and 41; probably the replies from other colleges and universities will not alter these ratios very much.

These numerical statistics show that attention to our science has been awakened: in fact, it is receiving a steadily-increasing amount of recognition. In fully one-half of these institutions, from the lower schools to the higher universities, some form of laboratory method is pursued—that is to say, students are required to make personal observations, experiments, and deductions. They study the daily weather map and develop habits of individual thought. In a matter that is so complex as the weather, no text-books can replace the daily map, personal observations, and independent study.

Concerning meteorology as a branch of mathematical physics, I believe that the courses given to graduate students at George Washington University by my colleague Prof. F. H. Bigelow and myself are as yet the only effort in that line; but the subject is so attractive and important that we must hope that others will take up this very promising line of work.

MAP-MAKING IN THE UNITED STATES.

By Cyrus C. Adams (New York).

Abstract.

Our map houses have not reached the stage in which first-rate production is possible. There are good reasons why this so. The best map of a region cannot be made unless it is based upon a thorough topographic survey. These surveys are almost invariably made by the Governments, because they are too laborious and costly for private enterprise. It is in those countries whose Governments have been most energetic in providing scientific surveys of their domains that private map-making has been most developed and is producing maps of the best quality. But it is only within a few years that our Government survey has covered areas so large that the topographic sheets might tend to encourage the establishment of map houses with the best cartographic appliances and conducted under strict geographical supervision.

Young map firms expect to base success upon the patronage of their countrymen, whose demand is chiefly for maps of parts of the home territory or of all of it. But we have not possessed the good surveys upon which to base good maps; hence there is only beginning to be an incentive for commercial map houses to develop superior map establishments in our country.

The existing map houses do not seem to be able to deal adequately with the better map material. We need not wonder at this. We have no schools in which young men may cultivate natural talent in this direction. Some surveying for map-making purposes, some plane-table work, are taught in the Yale Forest School, some similar work is done at Cornell and possibly at one or two other institutions; but we have really no schools in which a person may acquire technical and scientific training in the theory and practice of cartography in its present development.

On the other hand, in the German-speaking countries of Europe, there were in progress, during the summer semester, this year, cartographic courses in seven of the universities and higher schools; and this winter the subject is being presented in nine of these institutions. Similar facilities are greatly needed in our country.

The plea of some map houses that the public wants nothing better and will pay for nothing better than the maps they provide is not valid, for we have witnessed the embarrassment to which publishers of text-books and works of reference have been subjected by purchasers who do not accept without protest maps that are misleading. There is in New York more demand than supply for persons having the knowledge, facilities, and time to revise the finished work of the map firms, the publishers believing it to be necessary to incur this additional expense.

There are encouraging features. Our map-makers are not insensible to criticism. They are now less lavish and indiscriminate in the use of colours. Many black-and-white maps are excellent, especially if publishers incur the expense of having them revised before the plates are cast. The students in some training schools for teachers and in many of our class-rooms are becoming familiar with better and more accurate maps, many of them of foreign origin.

Many geographers have voiced the same idea that the late Sir William Wharton expressed in August last, when he said: "Good maps are the foundation of all sound geographical knowledge." Good maps bear some such relation to geographical study that tables of logarithms do to computation. They are economizers of time and of labour. As objects of artistic and ingenious workmanship, they gratify the æsthetic sense; as expressing graphically a wide range of scientific fact and its approximations, they lighten in many ways the labour of accumulating data. Dr. Hermann Wagner has said that from his study of maps he derived a large part of the material for his great work on geography. Upon what basis more inspiring, suggestive, and informing may we ground a study of the Galla Lands of Africa than upon Carl Schmidt's recent map showing the seventeen routes of explorers since this large white space was entered in 1888 and the records of geographical and ethnological discovery along these routes, here assembled on one sheet?

From such progress as we have made in the concept of geography, in methods of teaching and utilizing geography, it is only natural if we infer that some day we shall supply our own maps. Every geographical worker and teacher may help to hasten this day. Trained teachers should know how they may enliven and enrich their school work with good maps. In the training schools they should know about those atlases that are not expensive though among the finest of map products, such, for example, as the Sydow-Wagner School Atlas, which would be an inspiration in their daily work. The pupil who begins to appreciate the difference between orographic features, shown meagrely by rough hachuring, more or less haphazard, and the scientific expression of them on good maps is acquiring an appetite for good things.

Many geographers require frequently to have maps made. Even though they may not have the technical skill of the trained cartographer, they will be helpful if they give the map-maker the best materials and insist upon at least an approximately adequate expression on the plates of the information desired. Some very good work has appeared, especially in the later text-books, by means of geographic supervision outside the map houses.

Our map products should be described by writers who review them in publications for just what they are. Mistakes may be excused or leniently dealt with; but error that is habitual, characteristic, and glaring, the fruit of carelessness, indifference, or ignorance, will some day be tolerated no more in our maps than in our text-books.

Our geographical magazines should consider it a pleasure to commend what is good in our maps and a duty to point out that which misleads. Every geographical society should set its cartographic standard high, and maintain it, even though compelled to go far for its maps.

If the influence of geographers and educators can prevail with Congress to place maps and map plates with English nomenclature on the free list when the tariff schedules are revised, it should be exerted. It will be time enough to put a duty on these products when we have in our country a few such masters of map-making as Ravenstein, Scobel, Fischer, and Schrader, and the experts of the Gotha and Edinburgh houses to build up what would truly be an infant industry.

Perhaps organized effort and a show of doing things through some society would not be a wise procedure; but this Association should keep map improvement in view, and be operative through its Council at all times, so that if circumstances arise when its influence, or the concerted influence of all the geographical organizations of the country, may properly be exerted, the helpfulness of the Association may be fully enlisted.

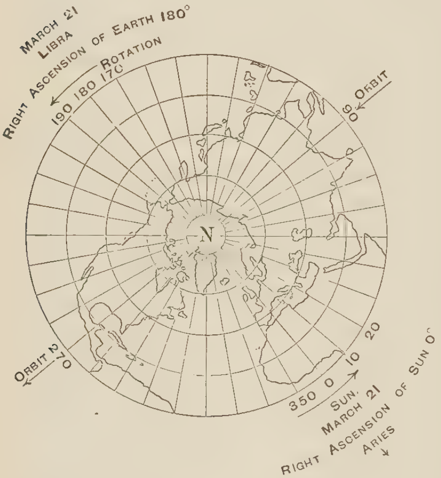
Good maps always in the schoolroom and reiterated insistence upon this reasonable requirement—good quality of our map products—will tell at length in the introduction of better plants.

A MODIFIED POLAR PROJECTION ADAPTED TO STUDIES IN DYNAMIC METEOROLOGY.

By Cleveland Abbe (Washington, D. C.).

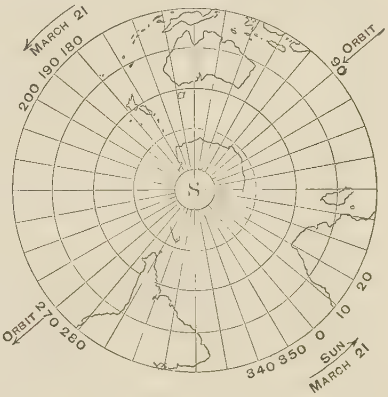
The maps of the globe on which the climatologist usually exhibits the general features of the condition of the atmosphere are either the Mercator projection, which is more properly called a development, or the various forms of stereographic, equal surface, and polyconic projections.

A polar projection showing the isobars, isotherms, and winds of the northern hemisphere was, I think, first used by the Signal Service (1875) in connection with its publication of the "Bulletin of International Meteorological Observations Taken Simultaneously at 12h. 43m. Greenwich time." This was, however, an arbitrary projection, in which meridians were represented by radial straight lines and parallels by concentric equidistant circles; therefore, angular longitudes and latitudes were not distorted, but areas and linear distances and angular bearings or azimuths were subject to a varying distortion.



Whatever polar projection we adopt to suit the needs of a special problem, there is one feature that is common to them all—one that may be of little importance to the cartographer, but which is of fundamental importance in relation to all motions, and especially to the dynamics of the atmosphere—viz., the direction of the rotation of the globe.

The northern and the southern hemispheres rotate together around the earth's axis in the so-called positive direction; it is therefore very important that this rotation should be presented to the mind of the student correctly. It is highly embarrassing and confusing to use the ordinary polar projections in which the northern hemisphere is depicted as seen from above the North Pole and the southern as seen from above the South Pole. This causes a reversal of the direction in which the rotation is counted, as though the two halves of the sphere were revolving in opposite directions. Our atmospheric and oceanic currents, and even our earthquake phenomena, depend on the uniform direction of rotation.



I have therefore prepared and used two polar maps as seen from above the North Pole only; the globe may be considered to appear transparent or both hemispheres may be supposed projected simultaneously on the same equatorial plane. The maps are to be superposed as if printed on the right-hand pages of two successive leaves, so that the centres and the similar meridians of the Southern Hemisphere shall be directly below those of the Northern Hemisphere. The angular rotation on both maps is in the same direction, as shown by the arrows. The numeration of angles continuously from 0° to 360° in the outside circle is, strictly speaking, not a numeration of longitude but of angular motion. The numbers are not supposed to be attached to the revolving globe; they belong to a stationary framework, outside, and serve to show the position of the Greenwich meridian at any moment after Greenwich mean noon. The lines 180°-N-0 and 180°-S-0° pass through the sun on March 21st, toward Aries and the zero of astronomical right ascension.

This arrangement has several advantages:

(1) The temperature, pressure, and winds at the outer edge of the Northern map are coincident and continuous with those immediately below on the outer edge of the Southern map.

(2) The equatorial tendency of a moving body is toward the right hand in both maps.

(3) The circulation of the air in the lows is the same in both maps—*i. e.,* the same as that of the globe itself; in the highs it is, of course, opposite thereto.

(4) The disturbance of the ideal planetary circulation by the influence of continents and oceans is beautifully brought out, and especially the contrasts between the northern land and the southern water surfaces in similar latitudes.

(5) An especially instructive laboratory experiment consists in establishing models of the Northern and Southern Hemispheres analogous to these polar maps upon the same vertical spindle, the

southern map being at a convenient distance below the northern map. An equatorial rim is supplied to each, so that water may be introduced—shallow (to represent the ocean) or deep (to represent the atmosphere). A slow, uniform rotation is given to the spindle; a moderate heat is applied below the ocean or the continents, and the local circulation is shown by little floats. Although this is not a perfectly analogous mechanical representation of the earth and atmosphere, yet it seems to lead the student up to the true problems of meteorology as studied in the light of Helmholtz's principle of dynamic similarity.

PROOF OF THE EXISTENCE OF THE UPPER ANTI-TRADE AND THE METEOROLOGICAL CONDITIONS AT LESSER HEIGHTS IN THE NORTHERN TROPICS.

By A. Lawrence Rotch (Blue Hill Meteorological Observatory, Massachusetts).

It has generally been believed that the trade-winds which blow towards the equator there rise and flow polewards above the trade-winds, as southwest and northwest currents in the northern and southern hemispheres, respectively; but there has been no proof of this theory, excepting observations of the drift of high clouds and of volcanic dust and a few wind observations on tropical mountains. These observations, however, are most scanty in the region of greatest interest—namely, over the Atlantic, where two years ago the thermal and hygrometric conditions prevailing in the free air above the trade-winds were also entirely unknown.

The exploration of the atmosphere in the trade-wind region of the Atlantic by the use of kites was first proposed by the writer at the Glasgow meeting of the British Association in 1901, in consequence of his successful experiments made during a voyage from Boston to Liverpool which demonstrated that, with a vessel navigable at will, meteorological data could be obtained with kites independently of the natural wind. In order to organize such an expedition to explore the tropical atmosphere, applications for aid were addressed to the Carnegie Institution and to the Prince of Monaco, but in both cases without receiving the desired help. In 1904, however, Professor Hergesell, President of the Commission for Scientific Aeronautics, succeeded in interesting the Prince of Monaco in the scheme, and upon his steam-yacht the *Princesse-Alice,* during the summer, sixteen kite-flights were made above that part of the Atlantic bounded by Spain, the Canaries, and the Azores. Although a height of nearly 15,000 feet was reached, the southwest current, which should correspond to the theoretical anti-trade, was never encountered. From the fact that the kites frequently exceeded in height the Peak of Teneriffe, Professor Hergesell concluded that the southwest winds, which have been observed on this mountain, are due to the influence of the island, and that the exchange of air takes place through the northwesterly currents which he observed. These astonishing conclusions led M. Teisserenc de Bort and the writer to organize an expedition for the purpose of testing Professor Hergesell's results. Upon the *Otaria,* a fast steam-yacht purchased by M. Teisserenc de Bort, M. Maurice of Trappes Observatory and Mr. Clayton of Blue Hill went during the months of July and August, 1905, from the Mediterranean to latitude 9° North, *via* Madeira, the Canary and Cape Verde Islands, returning to the Azores. To attain a greater height than was possible with kites, paper pilot-balloons were provided, which, after being filled with hydrogen, were liberated from the islands mentioned, and their drift at increasing heights was measured from the ends of a base-line on the shore. One balloon provided with self-recording apparatus was launched from the boat off the island of Palma (Canaries), but it was not recovered. Such observations from instruments carried by kites were, however, obtained over an extensive region. Sailing from Boston on the White Star steamer *Romanic* in June, 1905, Mr. Clayton executed, on the voyage to Gibraltar, six kite-flights to an average height of about 3,000 feet. There he joined the steam-yacht *Otaria,* and, with the assistance of M. Maurice, seventeen kite-flights were made over the open ocean, besides two in the harbour of Santa Cruz (Teneriffe) to investigate the sea-breeze. In this way continuous records of barometric pressure, temperature, humidity, and wind-velocity were generally obtained from sea-level up to the highest point reached by the kites, which was 7,500 feet. Direct eye-observations to a still greater height were made by Mr. Clayton upon the Peak of Teneriffe, and to a lesser height upon the Peak of Fogo (Cape Verdes).

The atmospheric circulation was found from these observations to be as follows: (1) North of Madeira and near the Azores the upper winds, as was already known by observations of clouds, are chiefly from W. and N.W., this region lying to the north of the barometric maximum over the ocean and beyond the trade-wind zone. (2) The winds blowing toward the equator are from N.E. to E. in the region below half a mile, and generally from N.W. to N.E. throughout a region extending to a height of two or three miles. (3) The return current from the equator, or anti-trade, is formed by winds having a southerly component, being generally S.W. in the latitude of the Canaries and S.E. near the Cape Verdes, these winds having been observed at both places by balloons up to a height of seven miles. From the observation of clouds and volcanic dust it was already known that the east wind in the vicinity of the thermal equator extends very high. Notwithstanding the great thickness of these currents their density is necessarily small. The change in the direction of the upper winds from S.E. to S.W., in going north from the equator, is caused by the earth's rotation.

The thermal and hygrometric properties of the atmospheric strata up to a height of three miles are these: (1) In the surface trade, which blows with a moderate velocity from N.E., the temperature decreases at the adiabatic rate in nearly saturated air. (2) Above the surface-wind is a calm belt, in which the temperature is higher and the humidity much less than it is in the lower stratum. Above the plane of inversion the wind comes from a direction to the left of the lower wind, when facing it, and blows with a greater velocity. (3) The third stratum, beginning at a height of two or three miles, which moves rapidly from the E. in equatorial regions and from a general southerly direction between latitudes 15° and 30° North, is potentially warm and has a low relative humidity, although clouds float in it. A rise of temperature occurs at the junction with the intermediate current.

The decrease of temperature with increasing height on the northwesterly slope of the barometric maximum near the Azores is quite different from that on the southeasterly slope, the former region having a comparatively slow decrease, at least up to the height of a mile, whereas in the latter region the temperature falls at the adiabatic rate up to the level of the cumulus clouds (a height which varies from day to day but averages, perhaps, half a mile), where there is a decided inversion of temperature.

The vertical distribution of temperature and humidity first stated does not differ materially from that found by Professor Hergesell during the cruises of the *Princesse-Alice* in 1904 and 1905; but his last observations, which were made with balloons carrying to a greater height than the kites' self-recording instruments, still fail to show, except in two cases, the existence of the upper current from a southerly direction. Since Professor Hergesell expresses his belief that the results obtained by the Franco-American expedition were influenced by the proximity of the African continent or the islands, its promoters are about to make observations from the *Otaria* to the west and south of the regions already explored by them.

NOTES ON THE MISSISSIPPI RIVER FLOOD OF 1903 AND ON THE FLOODS OF OTHER YEARS.

BY ROBERT MARSHALL BROWN (Worcester, Mass.).

Abstract.

Great floods are not experienced annually. They occur at greater and not regular intervals. The springs of 1882, 1897, and 1903 were seasons of notable floods. There is no periodic recurrence of great floods, as far as can be ascertained. The floods of the springs of 1897 and 1903 were almost duplicated in height by the floods of 1898 and 1904.

The tendency in flood calculations is not so much to compute when a great flood may be expected as to approach the stage to which the waters are liable to rise.

The waters which throw the river in flood are not drawn from the entire extent of the Mississippi Basin. The tributaries are in flood in different months. The ordinary sequence of floods is, first, an Ohio flood from the rainfall of the Southern Appalachian type in February and March; then the Upper Mississippi, followed by the Missouri.

It is not uncommon for the floods of the latter two to unite. These three rivers yield 63 per cent. of the total discharge of the Mississippi. The remaining 37 per cent. is divided among the other tributaries. The St. Francis, White, and Arkansas Rivers, draining the Ozark plateau, contribute about as much water as the Missouri. The other rivers are too small or too near the mouth of the Mississippi to be dangerous. All these rivers have never been known to be in extreme flood at once. Such a coincidence would produce a discharge of more than 3,000,000 cubic feet per second—twice as large as has ever been observed. The value of this succession of floods is enormous. On the fact of it depends to a large degree the protective value of the present system of levees. It is beyond the bounds of probability—although we must admit with apprehension not beyond the limit of possibility—that a flood may be experienced much greater than any of the excessive floods of the last hundred years.

A flood tends to lose its power as it goes down stream, and in a long river there is a small chance of a disastrous flood in its lower reaches. The flood-crest rises above the general level of the swollen stream. From the crest the water will have a movement forward equal to a normal flow because of its cross-section and the slope plus the impetus due to gravity dependent on the height of the crest. On

the other hand, in the up-stream portion of the flood-crest the water must move on a less inclined slope, and a retardation of the waters occurs. Thus the forward slope of the flood-wave tends to spread over an ever-increasing space as it progresses; and if the river is long enough, the flood-wave will suffer thereby self-destruction. The flattening of the crest by a down-stream progress is partly shown by the differences between the high and low water stages at various stations.

The movement of this crest down stream is not uniform. The hydrographs of the lesser as well as the greater floods show no great disparity of time between the arrival of the crest at Arkansas City and Greenville, forty miles below. In fact, the hydrograph of the 1903 flood seemed to show that the flood-crest arrived at Greenville at nearly the same time as at Arkansas City. If there is any difference, it is in favour of the crest arriving at Greenville, the down-river station, before it reached its highest stage at Arkansas City. In the same connection the figures of the height of crests at these stations during the 1903 flood and the previous highest recorded flood are used. The difference between the height of the crests in the latter flood, at Arkansas City and Greenville, was 5.15 feet; between Greenville and Lake Providence, 2.21 feet—a drop of 5.15 feet in 40 miles and 2.21 feet in 64 miles. There are no tributaries to the trunk stream in this distance. In the 1903 flood the figures read a decrease of 3.9 feet in 40 miles to 2.7 feet in the next 64 miles. The rearrangement of the high-water levees just below Arkansas City since the flood of 1898, and which increased the width of the high-water stream, does not allow a correlation of these figures, although they point, one in a less degree, to the same condition. The very striking curves in the river above Greenville may explain in part these irregularities. A ponding of the waters will take place above the bends. This will allow the waters on the down-stream side of the crest, which are moving faster, to drain off some of the ponded water at a time when there is danger of disastrous results. Thus the slope below the accumulating flood-wave will be a lessening one. At the same time the back slope will also be decreasing because of the increasing height of the crest, and the ponding will go on less and less slowly. However, there will be a too great disparity of level between the upper back slope stage and the lower down slope stage. In this lies the danger of a cut-off. The retardation of the flood-wave by the bends allows a draining of the down-stream side of the crest; if, then, the accumulation of waters above the bends is not far in excess of average flood conditions, the crest at Greenville will be lower than the normal decrease expectable from the down-river progress in a straight reach of the stream. This lower crest may be attained almost simultaneously with the higher wave up stream.

The ponding of the waters on the up-stream side of the bends precipitates the cut off in a stream's natural development. If a cut-off occurs the disparity of water-levels above and below the neck, yielding an increase of slope, accelerates the movement of the wave-crest. This sudden jump forward of the wave-crest nullifies the effect of the back slope for a time, and tends to ameliorate the flood conditions up stream. As the crest height below the bends may be attained almost simultaneously with the higher wave above, the result of a cut-off is to increase the normal height of the crest below the bends, which, being in some wise the resultant of two crests, and being also some fifteen to twenty-five miles farther down the river, gives good reason for apprehension on the down-stream side. In the Devil's Elbow cut-off, in 1876, these conditions were marked. The present levee system, now about 70 per cent. completed, is constructed to restrain a flood flowing in a given, very irregular channel. Untiring efforts are being expended to keep the channel unchanging. The engineers are forever talking about a cut-off destroying the regimen of the river. There can be no doubt but that a cut-off will turn the force of the current against banks now experiencing little scour, and will deposit sand in places, perhaps, where the levee is constructed to withstand the force of a flood-wave. To prevent the invalidation of a part of their work, the increasing vigilance and outlay over other portions of the levee system, and, above all, the lottery of new conditions, every effort is being made to prevent a cut-off. At Ashbrook Neck, between Arkansas City and Greenville, where in the natural scour of the river 2,000 feet out of 4,500 was removed in thirteen years, and, had not man interfered, at the above rate a cut-off would have been precipitated a few years ago, the most uncertain conditions exist. During the excessive floods the water overflows this point and the points directly below. The question arises whether or not a cut-off can be averted at this point.

The flood season is the working day of the river, It is then that the great bulk of sediment is carried and that much of the work of corrasion is done. The deposit of the materials held in suspension by a flooded stream, if deposited in the bed, is liable to be a detriment to low-water navigation. The formation of a channel, fitted for navigation, depends upon the rate of decline from a high-water to a low-water stage. A slow, gradual decline is beneficial. The River Commission states in regard to the low-water condition of 1903 that "at the beginning of the season it was expected that the high water of the spring of 1903 would result in the formation of many obstruction bars, and that conditions requiring extensive dredging operations would early develop." "The river did not reach a stage requiring extensive dredging until (nearly the close of the season, on) about December 5." In contrast to this the following fall, 1904, "the dredging season covered the period from August 22 until December 31. . . . Low stages were reached early in the season, and lasted until quite late." The hydrographs of the two seasons show a gradual decline of the flood during the summer of 1903 and a more sudden decline during the same season of 1904. On August 22, when dredging began in 1904, the river had fallen at Vicksburg 23 feet since July 24, or from 54 feet to 31 (Natchez datum), while during the same time during 1903 it fell but 2 feet, from 41 to 39, and it did not reach the 31-foot mark, the dredging-point of 1904, until November 25. Thus, it seems that the low-water channels are not so much affected by the height of the floods of the previous season as by the rate of decline of high water. This rate is influenced by the floods of the lesser tributaries. The second part of the paper discussed the efficiency of the levee system.

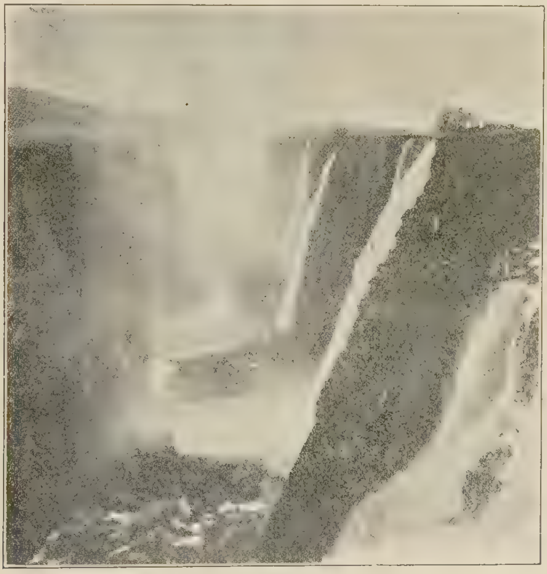
GEOGRAPHICAL RECORD.

MIKKELSEN'S ARCTIC EXPEDITION.—Captain Ejnar Mikkelsen, of Denmark, a member of Amdrup's expedition to East Greenland, and who has also seen service in Franz Josef Land and on the Greenland west coast, has completed his plans for the exploration of the Beaufort Sea to the north of Alaska. This part of the ocean between the Parry Archipelago and the New Siberia Islands, to the north of the track of the *Jeannette's* drift, is now the largest unknown area of the Arctic. Mikkelsen will enter this region because of his belief (which is shared by some of the leading authorities) that the movement of currents and tides, as well as other facts, point to the probability that there is still undiscovered land in this part of the Arctic.

His enterprise has received substantial support from the Royal Geographical Society and the American Geographical Society. The explorer had collected from various sources abroad all the funds that were thought to be necessary; but when he reached New York, early in February, it was found that he could not depend upon a whaling vessel to reach his destination, as nearly the entire San Francisco fleet is frozen in the ice off the north coast of Alaska. The American Geographical Society has supplied the funds needed to purchase the vessel required.

Having his own vessel, Capt. Mikkelsen will be able to make hydrographical researches near Bering Strait on his way to Cape Nelson or Cape Kellett on the west coast of Banks Land, where his small party will spend next winter. He hopes to be able to transfer several tons of provisions north to Cape Prince Alfred. He expects to spend 1907 in Banks Land and in Wollaston Land (where he will study the Eskimos who have as yet scarcely met the whites) and hopes also to make a trip to Prince Patrick Island to outline the still unexplored coast. He will procure sledges and dogs from the Eskimos, and early in the spring of 1908 the party will advance to the northern depot and start west over the sea, with thirty dogs, one pony, and provisions for about 132 days. Sounding apparatus will be carried, and it is not the purpose to get north of the continental shelf, as there is every reason to believe that no Arctic land rises from deep waters. The party will endeavour to follow a west-north-west direction to about 76° 30′ N. Lat. and 147° W. Long., and then return southward to Alaska or Wrangel Land. If land is found, only a rough survey will be made of it, and the party will return to organize a more effective expedition.

THE CHASM OF THE VICTORIA FALLS OF THE ZAMBEZI.—This interesting photograph of the chasm of the Victoria Falls was taken by Dr. H. R. Mill, and is published in the January number of *Symons's Meteorological Magazine,* of which he is the editor. It is the first photograph we have seen of this remarkable chasm. The picture shows the river at a very low stage of water, towards the end of the dry season on Sept. 12, 1905. "In the wet season," writes Dr. Mill, "the enormous volume of water would make it impossible to obtain such a view on account of spray, or to reach the standpoint from which it was taken. The chasm is 400 feet deep and a mile long." The entire river pours over the brink into the chasm and emerges from it through a narrow outlet into the gorge, which extends about 40 miles.



CHASM OF THE ZAMBEZI.

THE EVOLUTION OF SPECIES THROUGH CLIMATIC CONDITIONS.—In *Science* for November 24, 1905, J. A. Allen discusses the evolution of species through climate, in connection with a recent paper (*Science,* Nov. 3, 1905) by President Jordan. In the northern hemisphere most types of birds and mammals of northern origin show a gradual decrease in size from the north to the south in representatives of a conspecific group. This is most marked in the case of birds, in the non-migratory or partly migratory species. The most southern representatives are a fifth to a third smaller than the most northern representatives of the same groups. At the same time, although less generally, there is a relative increase in certain peripheral parts. Secondly, there is a change in coloration, a general restriction in area of white markings, and an increase in area of dark markings, as well as an increase in intensity of colour in areas of tints other than black or white—*e. g.,* yellows, browns, greens, etc., and also in iridescence. In low latitudes, high mountains represent the conditions of higher latitudes nearer sea-level. Grays, browns, and olives are found in regions of heavy rainfall, while pale tints accompany desert areas. Further, regional areas having peculiar climatic conditions show distinctive coloration of their animal inhabitants; in some instances new specific types develop.

In eastern North America, variations in size from north to south are gradual, corresponding with the gradual transition in climatic conditions. The same is true of the gradations in passing westward from the Atlantic to the Pacific and north to Alaska. Topographic conditions do bring about abrupt changes in climate at some points in the latter case, but, in general, the spread of the species is continuous. On the Pacific coast, from Lower California to the Aleutian Islands, there are nine recognized forms of song sparrows, gradually merging, the one into the other, there being no abrupt climatic or geographic barrier anywhere. If some of the intermediate forms were dropped out, the remaining ones might easily be taken for distinct species. Mammals, being sedentary, are even more susceptible than birds to climatic modifications. "In general—in birds and mammals, in which regional modifications are so potent—the main factor is climate, the action general, and the transitions between regions gradual."

R. DEC. W.

CONCLUSIONS OF THE LIGHTNING RESEARCH COMMITTEE.—A Committee organized by the Royal Institute of British Architects and the Surveyors' Institution, and including a representative from the Royal Meteorological Society, has made a report embodying the following practical suggestions:

1. Two main lightning rods, one on each side, should be provided, extending from the top of each tower, spire, or high chimney stack by the most direct course to earth.

2. Horizontal conductors should connect all the vertical rods (*a*) along the ridge, or any other suitable position on the roof; (*b*) at or near the ground-line.

3. The upper horizontal conductor should be fitted with aigrettes, or points, at intervals of 20 or 30 feet.

4. Short vertical rods should be erected along minor pinnacles, and connected with the upper horizontal conductor.

5. All roof metals, such as finials, ridging, rain-water and ventilating pipes, metal cowls, lead flashing, gutters, etc., should be connected to the horizontal conductors.

6. All large masses of metal in the building should be connected to earth either directly or by means of the lower horizontal conductor.

7. Where roofs are partially or wholly metal-lined, they should be connected to earth by means of vertical rods at several points.

8. Gas-pipes should be kept as far away as possible from the positions occupied by lightning-conductors, and, as an additional protection, the service mains to the gas-meter should be metallically connected with house services leading from the meter. R. DeC. W.

FORMATION OF NATURAL BRIDGES.—It is commonly believed that natural bridges, of which the Natural Bridge of Virginia is the best-known American example, are due to the falling in of cavern roofs, leaving only a part to span the stream which the destruction of the cavern has brought to the surface. By a study of the North Adams Natural Bridge, Professor Cleland has been led to the conclusion that in this case, at least, the origin is quite different. In this case the bridge seems to be due to the solution of the limestone along a joint plane near the former course of Hudson brook. At first only a small amount of water seeped along the joint plane, but after awhile it made a channel large enough to divert the entire brook under the surface, giving rise to the bridge. Walcott had previously offered a similar theory for the Natural Bridge of Virginia, and Cleland concludes that, while the falling in of cavern roofs may occasionally give rise to natural bridges, the most common cause for such bridges in marble, limestone, sandstone, and lava is that outlined above. R. S. T.

NOTES.

PROFESSOR ALBRECHT PENCK, of Vienna, has accepted the Professorship of Geography in the University of Berlin, left vacant by the death of Professor von Richthofen.

The *Revue de Géographie,* long published by Delagrave of Paris as a monthly, will hereafter appear as an annual review.

The *American Geologist,* which began publication in 1888, was consolidated on January 1st with the new journal *Economic Geology,* published at Lancaster, Pa. Professor Winchell, the editor, says that he relinquishes this scientific service owing to his desire, with advancing years, to find time for other contemplated work. The *American Geologist,* in the eighteen years of its existence, has certainly contributed its part to geological research and to improvements in the methods of geological work. It has been a monthly journal, but the new publication will appear semi-quarterly.

AS ANNOUNCED IN THE BULLETIN FOR 1905 (page 677), the Tenth International Geological Congress will meet on the 6th of September next in the City of Mexico.

Circular No. 2, issued by the Committee on Organization, presents a programme of excursions before the meeting of the Congress: one of 4 days, limited to 250 persons; one of 8 days, limited to 40 persons; one of 14 days, and one of 7 days, limited to 30 persons.

Four short excursions will be made during the session; and after the close of the Congress there will be two excursions, one of 20 days, limited to 250 persons, and one of 7 or 8 days, limited to 60 persons.

The cost of the excursions will be 20 francs a day for each person, and the price of passage by steamer and railway lines will be reduced 50 per cent.

Membership in the Congress (including a copy of the Report) is to be obtained by payment of 20 francs (8 Mexican dollars) to the Treasurer of the Committee on Organization, Mr. Juan D. Villarello, 5a del Ciprés No. 2728, Mexico, D. F.

THE NINTH INTERNATIONAL GEOGRAPHICAL CONGRESS.—A communication from the Geographical Society of Geneva, Switzerland, announces that the Ninth International Congress will be held in that city from July 27 to August 6, 1908.

A preliminary programme, together with a circular invitation, will be issued during the present year by the Committee on Organization.

BULLETIN OF THE GEOGRAPHICAL SOCIETY OF PHILADELPHIA.—This publication will hereafter be issued quarterly. The January number, in the high quality of its contents and its fine typographical appearance, maintains the reputation of the Society. The contents include a discussion of the Arctic drift-cask experiment by Rear-Admiral Melville and Henry G. Bryant, President of the Society; the first of a series of articles dealing with the regional and economic geography of Pennsylvania, by Walter S. Tower; a Survey, by Prof. R. DeC. Ward of Harvard, of some of the relations between weather and climate and a few of the more important diseases; a description of two geographical excursions by the Society from the pen of Mary S. Holmes; a short sketch of the life-work of the late Baron von Richthofen, and a list of recent accessions to the library. The Publication Committee which has the *Bulletin* in charge is composed of Prof. Emory R. Johnson, chairman, Laura Bell, Henry G. Bryant, and Walter Sheldon Tower.

THE ROYAL BOHEMIAN SCIENTIFIC SOCIETY, of Prague, announces the death on the 19th of January of its former Vice-President, Privy-Councillor KARL RITTER VON KORISTKA, in the 81st year of his age.

U. S. BOARD ON GEOGRAPHIC NAMES.—Decisions January 3, and February 7, 1906:

ALATNA: River, northern Alaska; large branch of Koyukuk River from the northwest. (Not Ah-lash-ok, Alashuk, Al-lash-ook, Allatna, Allen, Allenkakat, nor Oklashok.)

CHEAHA: Mountain, Clay County, Alabama. (Not Blue, Che-aw-ha, Chehaw, Che-haw-haw, nor Shinbone.)

GALOP: Island in the St. Lawrence River, St. Lawrence County, New York. (Not Gallop, Galloup, Galoup, Ile aux Galops, Isle au Gallop, nor Isle au Galop.)

JOHN: River, northern Alaska; tributary to Koyukuk River from the north near longitude 152°. (Not Alchickna, Ascheeshna, Fickett, nor Totsenbetna.)

KITTATINNY: Mountains, New Jersey and Pennsylvania. (Not Blue nor Kitatinny.)

*LINK: River connecting Upper and Lower Klamath Lakes, Oregon. (Not Klamath.)

MITYLENE: City and Island, Turkey. (Not Metelin, Mytilene, nor Mytilini.)

POROPOTANK: Creek, between King and Queen County and Gloucester County, Virginia. (Not Potopotank.)

PRATT CITY: Postoffice, railroad station, and town, Jefferson County, Alabama. (Not Pratt Mines.)

SHOSHONE: Indian Reservation, Fremont County, Wyoming. (Not Wind River.)

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* Reversal of former decision.

Spottsylvania: County and courthouse, Virginia. (Not Spotsylvania.)

Storey: Island, Prince William Sound, Alaska; just north of Naked Island. (Not Little Naked nor Story.)

Storey: Slough; one of the outlets of the Copper River, Copper River delta, Alaska. (Not Story.)

Weskeag: River, South Thomaston town, Knox County, Maine. (Not Gig, Keag, Wessawaskeag, Wessaweskeag, nor Westkeag.)

Wild: River, northern Alaska; a large affluent on the north side of Koyukuk River, near longitude 151° 30′. (Not Hokotena, Totsenbet, Totsenbetna, Totzunbetna, nor Totzunbitna.)

Big Flats: Town, Chemung County, New York. (Not Bigflats.)

Blocton: Town, Bibb County, Alabama. (Not Blockton.)

Gorham: Mountain, Mt. Desert Island, Hancock County, Maine.

Icicle: Stream emptying into Wenatchee River, near Leavenworth, Chelan County, Washington. (Not Nacicle.)

Ignacio: Lakes west of Animas Canyon, La Plata County, Colo. (Not Bishop, Columbine, Mamor, Molar, Pierce, Rockwood Lakes, nor Cascade Reservoir.)

Katalla: Bay, river, slough, and town, Alaska, near Controller Bay, Gulf of Alaska. (Not Catalla nor Catella.)

Navajo: County, creek, reservation, spring, town, and valley, Navajo County, Arizona. (Not Navaho nor Navajoe.)

Uinta: County, mountains, reservation, river, town, and valley, Uinta County, Utah. (Not Uintah.)

Wetumpka: City and precinct, Elmore County, Alabama. (Not Wetumka.)

American Geographical Society—Transactions for December and January.—On the 21st of December, 1905, the Council by unanimous vote awarded the Cullum Geographical Medal to Captain Robert F. Scott, R. N., for the Voyage of the ship Discovery and his sledge journey to latitude 82° 17′ S.

Transactions of the Society, January 5, 1906.—A Regular Meeting was held at Mendelssohn Hall, No. 119 West Fortieth Street, on Friday, January 5, 1906.

Mr. Charles S. Fairchild in the chair.

The following persons, recommended by the Council, were elected Fellows:

Samuel T. Armstrong.
A. F. Estabrook.
J. G. Battelle.
Charles S. Butler.
André Champollion.
Edward Russell Coffin.
Thomas H. Curtis.
John F. Brooks.
Frank M. Cronise.
H. G. Dalton.
Francis C. Green.
Thomas Powell Fowler.
G. Stanton Floyd-Jones.
Jed Frye.
Frederick R. Franke.
Henry J. Gielow.
Robert R. Hollister.
John H. Bennett.
George H. Smith.
James H. Hickey.
John A. Hadden, Jr.
Gurden B. Wallace.
V. Clement Jenkins.
C. Ledyard Blair.
LeRoy Harvey.

The Chairman then introduced Dr. Otto Nordenskjöld, Commander of the Swedish Antarctic Expedition, who described the events of Two Years in the Ice of the South Pole.

Stereopticon views were shown.

On motion, the Society adjourned.

The Annual Meeting of the American Geographical Society was held at Mendelssohn Hall, No. 119, West Fortieth Street, on Tuesday, January 30, 1906, at 8.30 o'clock, P. M.

Mr. A. A. Raven in the chair.

The following persons, recommended by the Council, were elected:

Honorary Member—William M. Davis, Professor of Geology in Harvard University.

Fellows:

Arthur B. Lovejoy.
Richard P. Hart.
Stuart F. Randolph.
Mansfield Ferry.
A. Duane Doty.
Richard Billings.
James A. Garland.
Charles Landon Jones.
J. de F. Junkin, Jr.
Eugene Limedorfer.
William R. Moody.
Robert Lewis McKnight.
William E. Merrill.
Benjamin A. Morton.
William Houston Kenyon.
August Kuhn.
G. L. Kittredge.
W. J. Denholm.
Daniel S. Knowlton.
David H. Lyon.
Gustave Loeb.
Alexander McDonald.
W. K. Jewett.
Deming Jarves.
A. I. Moxham.
William F. O'Callaghan.
Lewis R. Morris.
Charles Oakes.
Henry F. Owsley.

The Annual Report of the Council was then submitted and read:

New York, January 18, 1906.

To the American Geographical Society:

The Council respectfully submit the following report for the year 1905:

The number of Fellows on the 1st of January was 1,265. The additions during the year were 178. The losses by death, resignation, etc., were 88, and the total Fellowship on the 31st of December was 1,355, of which number 368 were Life Fellows.

The additions to the Library number 4,594: Periodicals and Pamphlets, 3,588; Books, 637; Maps and Charts, 356; Atlases, 13.

Five Regular Meetings of the Society were held:

On the 24th of January President Peary addressed the Society on the Geographical Work of the World in 1904;

On the 21st of February Mr. Adolphe F. Bandelier described the Region of Lake Titicaca;

On the 28th of March Mr. Harlan I. Smith gave an account of Recent Archæological Discoveries in North Western America;

On the 18th of April Prof. E. L. Stevenson addressed the Society on the World as seen through the eyes of Mediæval Map-makers;

On the 28th of November Mr. Bailey Willis related his Experiences among the Chinese.

There have been published in the Bulletin, besides the Record, the Scientific Notes and the Book Reviews, thirty-one original papers.

For the condition of the finances reference is respectfully made to the report of the Treasurer, herewith presented.

Rooms in the Society's house have been placed at the disposal of the Geography Teachers' Association and the Association of American Geographers for their meetings.

All of which is respectfully submitted.

HENRY PARISH, *Chairman.*

LEVI HOLBROOK, *Secretary.*

The report of the Treasurer was then read:

Report of the Treasurer to the American Geographical Society for the year 1905:

GENERAL ACCOUNT.

The Treasurer respectfully reports:

On January 1, 1905, there was on hand a cash balance of		$2,600.71
During the year there have been received for Fellowship Dues, Sales of Publications, Interest on Investments, etc.		$22,598.01
		$25,198.72
There have been expended for Salaries, Meetings, Library, Publications, House Expenses, Insurance, Postage, etc.	$19,806.10	
Contribution to Peary's Arctic Expedition	1,000.00	
Invested in Mortgage	900.00	$21,706.10
On December 30th there was on hand a cash balance of		$3,492.62

Respectfully submitted,

WALTER R. T. JONES, *Treasurer.*

The Committee charged with the duty of selecting candidates for the offices to be filled made the following report:

NEW YORK, January 18, 1906.

To the Council of the American Geographical Society:

The Committee appointed to recommend to the Society suitable persons to be elected in January, 1906, to fill vacancies then existing in its offices, respectfully report that they recommend the election of the following-named persons to the offices below designated:

President.............Robert E. Peary (Term to expire in 1907).
Vice-President........William H. H. Moore (Term to expire in 1909).
Treasurer............Walter R. T. Jones (Term to expire in 1907).
Foreign Corresponding Secretary.........William Libbey (Term to expire in 1909).

Councillors.........
Francis M. Bacon,
John Greenough,
S. Nicholson Kane,
M. Taylor Pyne,
J. Hampden Robb.
(Terms to expire in 1909).

Henry Parish,
L. Holbrook,
A. A. Raven.
Committee.

Mr. C. C. Adams moved that Dr. Ralcy H. Bell be authorized to cast the vote of the Society for the candidates. The motion was seconded; Dr. Bell cast the vote and the candidates were declared duly elected.

The Chairman then read the following:

At the meeting of the Society held at Mendelssohn Hall, November 28, 1905, Mr. F. M. Bacon proposed that the By-Laws be amended as follows:

Amend Chapter I., Section 5, so that it shall read, "The name of any Fellow or Member of the Society may be dropped from the list by vote of the Council, without reference to the Society."

In accordance with Chapter XIII. of the By-Laws the proposed amendment was referred to the Council for consideration and report.

In Council December 21, 1905, the proposal to amend the By-Laws was considered and it was

Resolved, That the proposed amendment of Section 5, of Chapter I., of the By-Laws is eminently proper and should be adopted by the Society.

Resolved, That the Chairman or Secretary of the Council is requested so to report to the Society at its next meeting.

The Chairman then called for the yeas and nays on the adoption of the amendment and it was unanimously adopted.

Mr. Poultney Bigelow, the speaker of the evening, was introduced. He addressed the Society on An American Panama—some personal notes on Tropical Colonisation as affected by Geographic and Political Conditions. Stereopticon views were shown.

On motion, the Society adjourned.

NEW MAPS.

CANADA.—Resource Map of the Dominion of Canada. Scale, 1:12,000,000, or 197.3 statute miles to an inch (?). By James White, Geographer, Department of the Interior. Ottawa, 1905.

The distribution of agricultural, mineral, and other resources is shown by sprinkling the name of products over the map. This method must needs answer until sufficient information is available for showing approximately the areas of the resources and their distribution. A part of western Nova Scotia is one of the finest apple regions in America. But the word "fruit" stamped on this map gives little idea of the extent and approximate position of the part of the peninsula covered by these orchards. Some of the coal-field areas, however, are indicated, and the positions of the collieries are shown. The map will be helpful to students. A little manual of 20 pages gives the latest economic statistics of the Dominion. If the scale of miles is 197.3 statute miles to an inch, as printed on the map, the natural scale is 1:12,500,000.

LONDON.—Stanford's New Map of the County of London. Scale, 1:15,840, or 4 inches to a statute mile. 20 sheets. London: Edward Stanford, 1905. (Price, in sheets, 15s.)

This clearly-printed and excellent map in colours is a new edition, in which recent important changes have been inserted and the whole map carefully revised. The new edition is thoroughly up to date and will maintain the reputation of this map of the London County as fully satisfying every need of the public. The parks and open spaces controlled by the London County Council are shown in blue-green, other parks and open spaces in yellow-green, and the main roads are coloured brown. Altitudes in feet are given at frequent intervals.

RUSSIA.—Carte Ethnographique de la Russie d'Europe. Scale, 1:12,500,000, or 197.2 statute miles to an inch. By D. Aitoff. *Annales de Géog.* No. 79. Librairie Armand Colin. Paris, 1906.

A clear and good map in 17 tints showing the distribution of the races in Russia in Europe and in Caucasia. The map is based upon the census of 1897. In the colour legend the colours are arranged in the order of the number of persons speaking each language.

ANDREES ALLGEMEINER HANDATLAS.—In 139 Haupt und 161 Nebenkarten; nebst vollständigem alphabetischem Namenverzeichnis von etwa 240,000 Namen. Fünfte, völlig neubearbeitete und vermehrte Auflage. (Lieferungen 13-18.) Herausgegeben von A. Scobel. Velhagen und Klasing, Leipzig, 1905.

This new edition of Andrees Hand-Atlas will contain 37 more maps than the fourth edition. Thirty-eight plates will be entirely redrawn or now first introduced into the atlas. Among the new features are physical maps of Europe and Africa, a map showing distribution of minerals, geological and economic maps of Central Europe, an entirely new plate of Switzerland, and four more pages of African maps, including a physical map. There will be no addition to the number of the American sheets, but all will be revised. This atlas has been noted both for the superior excellence of its maps and its moderate cost. The edition now being issued will even enhance its standing from the scientific and cartographic standpoints, while its price for the map sheets in Lieferungen is only 28 marks, or about $7. The sheets thus far issued are especially conspicuous for the very large number of place-names printed with perfect clearness even in mountainous regions where brown is the predominating tint; and for the unexcelled methods by which sea-floor contours, soundings, and commercial routes are given. The index will contain about 240,000 names.

BOOK NOTICES.

Tabellarische Reiseberichte nach den meteorologischen Schiffstagebüchern. Kaiserliche Marine, Dentsche Seewarte. 8vo. Berlin, 1905, 2 Band. Pp. 200.

The "*Tabellarische Reiseberichte*" of the German Naval Observatory, of which we now have the second volume, are designed to accomplish three things; I. To give a complete list of the marine meteorological Journals sent in to the Seewarte and relating to long voyages. II. To present sufficient information concerning these voyages to enable any one to determine where each vessel was at a given time; thus persons who are studying some problem in marine meteorology or oceanography can find out for themselves how many German ships were within a certain area at a given time. III. They contain a brief summary of the most important nautical, meteorological, and oceanographical data collected by all the ships in all oceans. This is the unique feature of the publication. The data selected for this summary include the following: Limits of the trade winds; irregularities in the trades; storms; ice and icebergs; marked deflections of the ocean currents; notable variations in the water temperatures; marine earthquakes; dust storms and other striking phenomena. The advantage of these *Tabellarische Reiseberichte* as compared with other marine publications lies in the fact that we here have original observations, without any reduction or averaging, so that each student can do with them as he pleases. The sole limitation results from the selection of observations of certain kinds only, and from the bounds set by the available size of the publication. The present volume (dated Nov., 1905) contains the results of observations sent in during the year 1904.

R. DEC. W.

In the Heart of the Canadian Rockies. By James Outram. xii and 466 pp. 46 Illustrations, Index and Maps. The Macmillan Company, New York, 1905. (Price, $3.)

Every enthusiastic mountain-climber and lover of the sublime in nature will welcome this book. It deals with the Alpine region of the Canadian Rocky Mountains between 51° and 53° N. Lat., where the only American counterpart of the Alps is found—a region of striking grandeur and of vast areas of glaciers, culminating in the huge Columbia ice-field with an area of about 200 square miles.

Mr. Outram, during three summers, achieved some of the best ascents that have been made among these mountains. His book will specially appeal to mountain-climbers, but no one can read the story of the grandest of North American mountains and of the trails, lakes, valleys, forests, and fine air among the Canadian Alps without wishing to go there next summer.

Among all these mountains the Selkirks first achieved popularity; but they are described here only briefly in Appendix A, as Mr. A. O. Wheeler has written an exhaustive report on them which is about to be published by the Dominion Land Survey. The photographs give many glimpses of scenic grandeur. A sketch map shows in red the routes traced by mountaineers and explorers, and a very full index enhances the value of the work. Mr. Outram's volume is a desirable addition to the literature, still meagre, of a region that in its geographical and geological aspects and its scenic attractiveness is of great interest both to the man of science and the layman.

A History of the Pacific Northwest. By Joseph Schafer. xvi and 321 pp. Maps and Illustrations. The Macmillan Company, New York, 1905. (Price, $1.25.)

This volume tells, in a simple and readable manner, the story of the great region in the North West known as Oregon in the first half of the nineteenth century, and embracing the present States of Oregon, Washington, and Idaho. Very little space is given to such political phases as the organization and operation of the new State governments; but the unfolding processes by which the wilderness was tamed, homes were multiplied, cities built, and the Pacific North West was linked by commercial routes with all the world are the fascinating theme of the book.

This is a chapter in our history of intense human interest; and the author gives it additional charm by showing how this great civilization has developed under the special physical conditions prevailing there. He devotes fourteen chapters to the early part of this evolutionary period, and the remaining five chapters are practically a sketch of progress in the Pacific northwest from 1849 to the present time. An admirable index makes all the information accessible. The book is well illustrated.

BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY.

Vol. XXXVIII **1906.** **No. 3**

GLACIERS AND GLACIATION OF YAKUTAT BAY, ALASKA.*

BY

RALPH S. TARR AND LAWRENCE MARTIN.

LOCATION.—The Yakutat Bay Inlet penetrates the St. Elias chain just south of Mt. St. Elias, forming the only considerable indentation on the long stretch of regular coast-line between Cross Sound and Controller Bay. The inlet is in the form of a bent arm, the broad part where it leaves the ocean being called Yakutat Bay, the narrow portion near the elbow Disenchantment Bay; the remainder Russell Fiord, from which there is one large arm, Nunatak Fiord. For the greater part of its length the inlet is mountain-walled; but part of the shores of outer Yakutat Bay and the head of Russell Fiord are a low moraine and outwash gravel plain, formed during a former stage of greater glaciation. This plain is called the Yakutat foreland.

EXISTING GLACIERS.

GENERAL DESCRIPTION.—Four large glaciers descend from the mountains surrounding the inlet, three of them—the Turner, Hubbard, and Nunatak—entering the sea. The fourth, the Hidden Glacier, descends nearly to sea-level, but terminates at the head of a gravel plain built in Seal Bay by outwash gravels from the glacier. Besides these great glaciers there are two or three score more within sight of the fiord, some of them tributary to the large glaciers, others independent. Of the latter some descend nearly to the sea, others occur at the heads of valleys, and still others in the mountain cirques. Many of them have moderate slope, and there is every gradation from these to glaciers which occupy valleys having such a steep slope as to render the glacier ice unstable. In fact, one of these slid out of its valley while we were in the fiord.

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* The observations outlined below were obtained in connection with a geological study of the Yakutat Bay region by a United States Geological Survey party, in 1905, in charge of the senior author. A grant of money from the American Geographical Society made it possible to add the junior author to the party, as special assistant in physiography. Acknowledgments are due to B. S. Butler, the other member of the party, for assistance in this work.

Published by permission of the Director of the U. S. Geological Survey.

When Russell viewed the country north of Mt. St. Elias he found it to be "a vast snow-covered region" with hundreds of mountain peaks projecting through it—"a land of nunataks." The maps of the Canadian Boundary Commission bring this feature out clearly. The region northwest, northeast, east, and southeast of Yakutat Bay is partly drowned in ice-fields, all the valleys being ice-filled. The large glaciers are outlets of this interior ice drainage and quite different from ordinary valley glaciers, like those of Puget Peninsula* and the smaller glaciers along the bay, which are merely outlets of local ice basins. It is possible to go over ice divides from one large glacier to another, and in several instances the prospectors have made use of these glacial highways. It is an inviting and virgin field for geographical exploration.

All the larger glaciers were studied as fully as time permitted, and a number of the smaller ones were made the subject of some investigation. They reveal many interesting features, some of which will be described under the succeeding headings. The four large glaciers were studied and described by Prof. Russell, and later by Dr. Gilbert,† to whose photographs, descriptions, and interpretations we owe much.

THE HUBBARD GLACIER.—This great glacier, one of the largest in Alaska, descends from an unknown source far back in the St. Elias range, and advances boldly into the bend of the fiord, its icy cape forming one of the points dividing Disenchantment Bay from Russell Fiord. For about four miles it presents a jagged ice-cliff rising from 200 to 300 feet above the fiord and almost constantly discharging icebergs from its face. These discharges send out great ring waves, which spread to the neighbouring shores, causing a succession of breakers far down Disenchantment Bay, even beyond Haenke Island. The procession of icebergs, reinforced by a lesser supply from the Turner and Nunatak Glaciers, passes down Disenchantment Bay, and thence down the west shore of Yakutat Bay, often forming such dense bands as to seriously interfere with navigation. So much ice melts or goes ashore that little reaches the

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* This name is proposed for the peninsula between Russell Fiord and Yakutat and Disenchantment Bays. Puget, one of the earliest explorers of this region, certainly desires to have his name applied to some part of it.

† Harriman Alaska Expedition, Vol. III, GLACIERS, 1904, pp. 45–70.

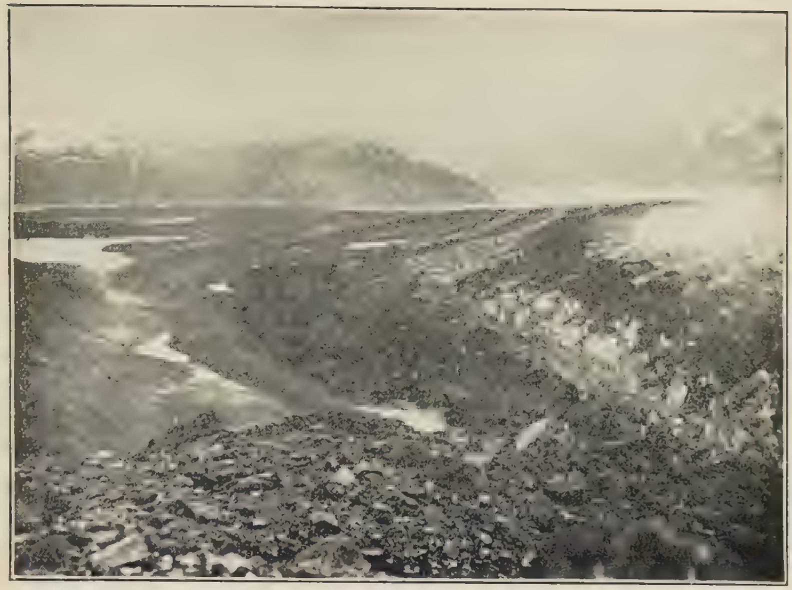

FIG. 1.—LOOKING SOUTHWESTWARD ALONG SOUTHEAST MARGIN OF HUBBARD GLACIER, SHOWING VALLEY BETWEEN IT AND VARIEGATED GLACIER, WITH MARGINAL LAKES ENCLOSED. SHOWS THE SWINGING OF THE HUBBARD MORAINE WESTWARD, NEAR THE ICE TERMINUS.

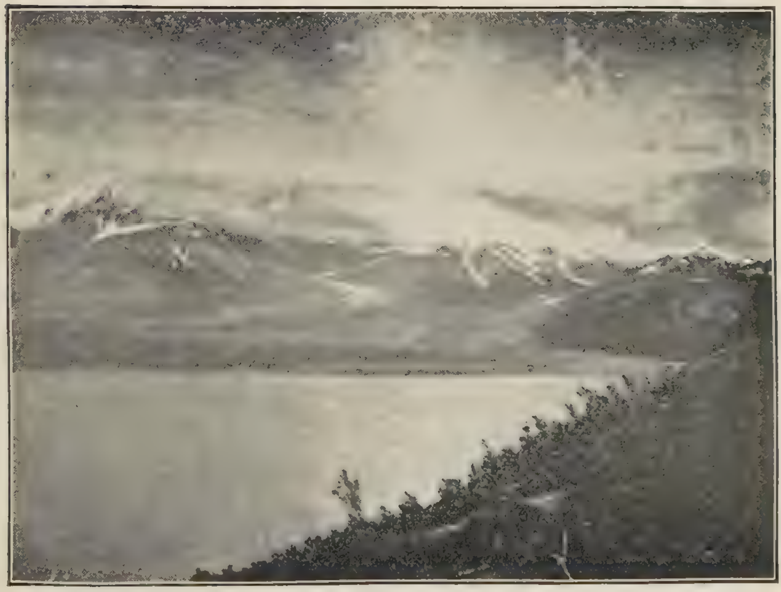

FIG. 2.—VARIEGATED GLACIER FROM ELEVATION OF 1,000 FEET ON GILBERT POINT. TWO GLACIERS DESCEND FROM THE MOUNTAINS AND UNITE TO FORM A MORAINE-COVERED, APPROXIMATELY STAGNANT, BULB-SHAPED PIEDMONT AREA. (SEE FIGS. 3, 4 AND 5.)

Pacific. Some of the ice is swirled by tides and currents into Russell Fiord, and this ice, added to the supply from the Nunatak Glacier, dots the surface of Russell Fiord as far as Cape Enchantment. South of this cape icebergs become rapidly less numerous, but scattered bergs were found nearly to the head of the bay.

The Hubbard Glacier is made by the union of two large arms to which numerous smaller glaciers are tributary. Both are greatly crevassed, as is the glacier below their union; and both are nearly free from moraines except at their margins. The western arm bears a medial moraine, and the lateral moraine of the north side of the eastern arm comes down to the sea nearly parallel to it. In consequence of the general absence of moraine the glacier front is, on the whole, a clean, beautiful ice-cliff except at the very margins, where it is blackened by morainic débris.

Both arms of the glacier have an abrupt descent where they emerge from their mountain valleys, thus introducing a step in the otherwise gentle slope of the ice. Apparently, if the ice were removed from this valley there would be revealed here an upward step from the main valley into each of these tributaries. Of the two glacier arms the eastern is the larger; and the direction of the ice-currents, as indicated by the medial moraines, is dominated by this arm below its union with the western tributary.

THE VARIEGATED GLACIER.—Adjoining the Hubbard Glacier on the south is an extensive moraine-covered area fed by two rather small glaciers (Fig. 2). The southern arm heads in a low divide (Fig. 3), from which another glacier descends eastward towards Nunatak Fiord; the northern arm heads among the mountains, and descends in a deep, narrow, sinuous mountain valley. The two, uniting, form a bulb-like expansion which is almost completely covered with moraine, and which in large part is nearly, if not quite, stagnant. In one place this piedmont bulb coalesces with the moraine-covered margin of the Hubbard Glacier; but for much of the distance it is entirely separated from the Hubbard Glacier (Fig. 1); and it is apparently not influenced in any way by the Hubbard Glacier, or the Hubbard by it. In consequence of this it has been deemed proper to consider this ice-mass a separate glacier and not a part of the Hubbard. Because of its vari-coloured moraines it is named the Variegated Glacier. It nowhere presents an ice-cliff to the sea.

A remarkable feature of this glacier is the presence upon it of a series of roughly concentric moraines, differing from one another in colour because of the predominance of rocks of different colours in the several moraines. One band is black because of the abundance of black hornblendic gneiss; another gray because of the presence of a large percentage of white granite boulders; a third is purple by reason of the great quantity of purple gneiss boulders; and a fourth is orange-coloured because of a bright orange rust on a gneiss which predominates in it (Figs. 3 and 4). Because of their strong colour and their marked height these moraines are prominent features even at a distance of five or six miles. They are not terminal moraines, but bands of débris on the ice surface, brought into strong relief by ablation. The highest of them rise over 100 feet above the base (Fig. 3), but all are found to have ice in them at the depth of a few feet. This ice is melting out so rapidly that there is little vegetation on the moraine because of its frequent slipping. If all the ice should melt out from beneath the moraines there would still be left a series of ridges differing prominently in colour, but of no great height.

The source of these vari-coloured moraines is evidently the cliffs enclosing the two contributing glaciers, where each of the rocks forming the moraines occurs. That the material is not basal in origin is proved by its highly angular character, which is that of lateral moraines and not of the ground moraine. Since the ice of the contributing glaciers is not now in even contact with some of the cliffs from which the rocks must have been derived, notably the black hornblendic gneiss, it is believed that these moraines were brought down during a higher stage of the ice, when the two glaciers pushed their bulb-shaped terminus out into the fiord. This moraine-covered ice is now melting away, but some ice still exists under the moraine almost down to the shores of the fiord. Under the moraine cover the ice is disappearing very slowly, and no difference is distinguishable in the photograph taken by Dr. Gilbert in 1899 from our view in 1905.

In the midst of this moraine is an extensive depression about 95 feet above sea-level and 150 feet below the level of the moraine-covered ice which separates it from the sea (Fig. 5). Into this depression pours water from each of the tributaries of the Variegated Glacier. The gravels which these streams bear are in part built into a gravel plain in the midst of the moraine; but some escapes through a gorge in the moraine-covered ice, through which the united glacial streams flow to the sea. That this outwash gravel plain is underlain by ice is proved by the existence of pits at present being formed on its floor by the slumping due to melting out of the ice-floor. This depression apparently represents an area of ice relatively clear of moraine, and consequently much more rapidly

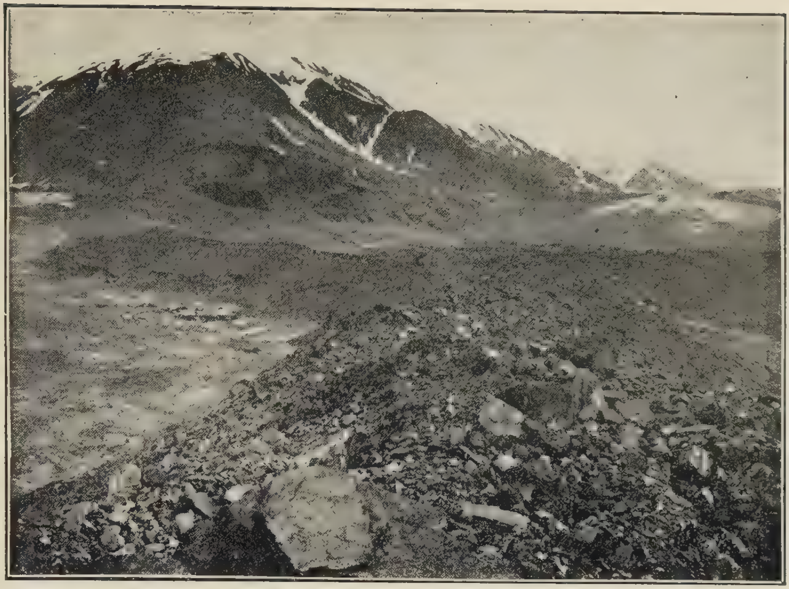

FIG. 3.—THE ORANGE GLACIER (ON THE LEFT), WITH THE INNERMOST OF THE CONCENTRIC MORAINES. THE THROUGH-GLACIER ARM OF THE VARIEGATED GLACIER SHOWS ON THE RIGHT. VIEW LOOKS NORTHEASTWARD, AT ELEVATION OF 870 FEET. CAMERA STANDS ON CREST OF MORAINE BENEATH WHICH IS ICE.

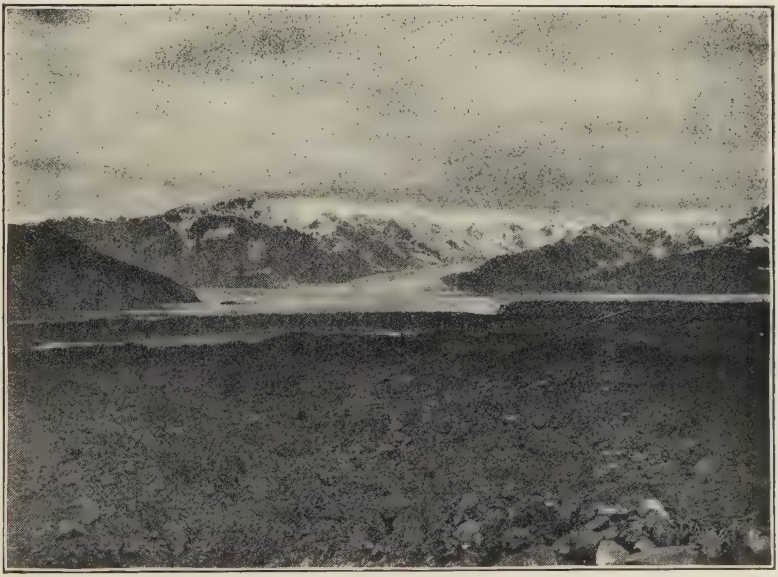

FIG. 4.—MORAINE-COVERED, BULB-SHAPED TERMINUS OF VARIEGATED GLACIER, FROM ELEVATION OF 850 FEET, LOOKING SOUTHWESTWARD. TURNER GLACIER IN BACKGROUND. THE CONCENTRIC MORAINES ON THE GLACIER, AND THE GRAVEL PLAIN BETWEEN THEM ARE BROUGHT OUT.

lowered by ablation. On either side the moraine-covered ice rises abruptly 100 feet or more. There is represented here the rather anomalous condition of glacial streams emerging, not from the ice terminus, but two or three miles from it, flowing over and through the glacier, and building an outwash gravel plain upon it.

THE TURNER GLACIER.—This glacier, approximately a mile wide in its mountain valley, spreads out in a flat, fan-shaped ice-foot on emerging from its valley, and by this means more than doubles its width at its terminus in Disenchantment Bay. Like the two arms of the Hubbard Glacier, the Turner descends by a step from its mountain valley (Fig. 6); and this is interpreted as indicating that the Turner Glacier valley is hanging well above the level of the main valley occupied by Disenchantment Bay. The glacier is greatly crevassed, and is evidently actively advancing, since there is frequent discharge of icebergs along its sea cliff, which, by Locke level, was found to rise about 200 feet above the water. Along each margin there is a narrow band of lateral moraine, which at the front rests on the land, forming a dirt-laden toe projecting from the ice-foot. There is also a medial moraine.

THE NUNATAK GLACIER.—A few miles above the terminus two large arms unite to form this tidal glacier (Fig. 8). The southern arm heads in a broad, low divide—a characteristic feature of many glaciers of this region. Instead of being formed by the union of a series of tributaries fed from lofty cirques and snow fields, this glacier, like many others in the region, rises by moderate grade to a flat ice divide, filling a broad valley from side to side and sending glaciers down from the divide in both directions. Tributaries enter from the valleys of the enclosing mountains, but at least a part of the glacier supply comes from the accumulation on the broad, flat divide which rises well above the snow-line. The grade is so slight across the divide that several years ago the Nunatak Glacier was used as a highway by large numbers of prospectors, who crossed over this ice divide into the Alsek valley. For this condition of glaciers, extending up to broad ice divides, and continuous with similar glaciers extending in the other direction, the name *Through Glaciers* is proposed (Figs. 7 and 8).

About two miles back from its terminus the Nunatak Glacier divides into two distributaries, or tongues, the smaller ending in a land valley, the larger, about a mile wide, ending in the fiord, in an ice-cliff (Fig. 7), from which there is incessant discharge of bergs. These two tongues are separated by a rock hill rising 1,440 feet (by barometer) above the fiord. When this glacier was first seen by

Russell in 1891 its two arms completely encircled this hill, whence the name Nunatak Glacier. In 1905 the two ice-tongues did not more than half surround the nunatak.*

Just south of the terminus of the land end of the Nunatak Glacier there is a pronounced hanging valley, from which a glacier emerges, and, descending over the lip of the hanging valley, rests on a series of ledges formed by lateral sculpturing of the cliff face during a recent stage of higher ice (Fig. 9). This hanging glacier terminus, with its crevassed steps, suggested to Dr. Gilbert the very descriptive name of Cascading Glacier. On the north wall of the fiord, just below the terminus of the sea end of Nunatak Glacier, is another hanging valley occupied by a glacier; but this one does not pass beyond the edge of the hanging valley, and its terminus is covered with moraine (Figs. 14 and 15).

THE HIDDEN GLACIER.—This large glacier, about a mile wide, descends with moderate slope from a broad, flat ice divide to within a little more than two miles from the sea. Its surface is only slightly crevassed, and it is very clean and free from débris. Even the lateral moraines have but moderate development. From its front emerge two glacial streams, the larger, a rushing torrent, coming from the south side. These streams are building an outwash gravel plain in the valley (Fig. 10). This plain fills the valley bottom from the ice terminus, where its elevation is 150 feet, to the sea at the head of Seal Bay, forming a gently-sloping valley-bottom plain over which the glacial streams flow in braided courses. The upper part of this plain occupies the site of the ice terminus when photographed by Dr. Gilbert in 1899;† and, near the glacier, ice is visible beneath the gravel plain. That the ice underlies the gravel plain for at least a mile below the present terminus of the visible glacier is proved by the presence on this plain of numerous pits and kettles from a few feet to 250 feet in longer diameter (Fig. 11) and 5 to 15 feet deep. These kettles have steep, angular gravel margins, which were in process of development during our visit, being surrounded by a cracked, faulted, and fissured area, due to the withdrawal of support from beneath. Some of the kettles were dry, but many contained water, and from some clear, cold water flowed away, to form minor streams on the gravel plain.

As has been shown by Dr. Gilbert, who first described this plain, the presence of ice beneath the gravels is here giving rise to a *pitted plain*—a phenomenon with which glacial geologists are fa-

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* For this hill the name Gannett Nunatak is proposed, after Henry Gannett, whose maps of the Nunatak and other glaciers show the position of the ice-fronts in 1899.

† See Harriman Alaska Expedition, Vol. III, Plate VI, opposite p. 56. Compare with Fig. 15.

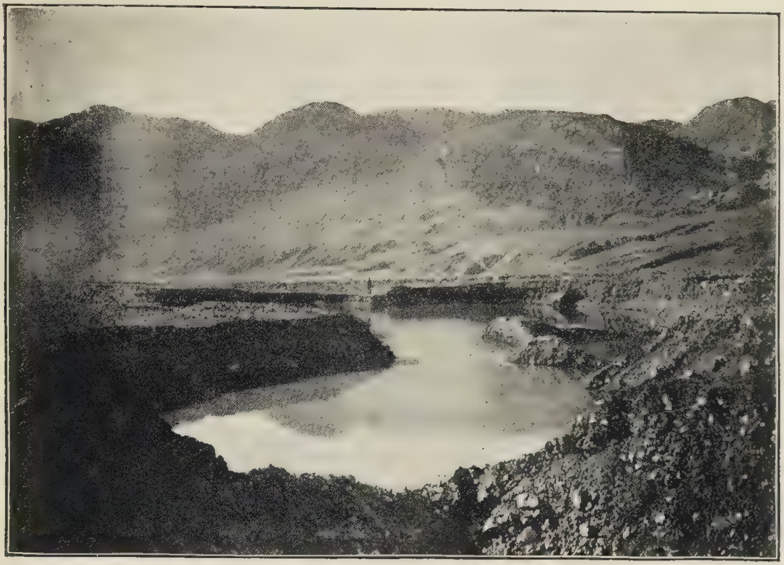

FIG. 11.—KETTLE IN OUTWASH GRAVEL PLAIN IN FRONT OF HIDDEN GLACIER, CAUSED BY MELTING OUT OF ICE BENEATH THE GRAVEL. OVERRIDDEN, HIGHER LEVEL GRAVELS SHOWN ON THE RIGHT, NEAR MOUNTAIN BASE. THE ICE HAS LEFT THE VALLEY SO RECENTLY THAT VEGETATION HAS NOT YET OCCUPIED THE GRAVELS.

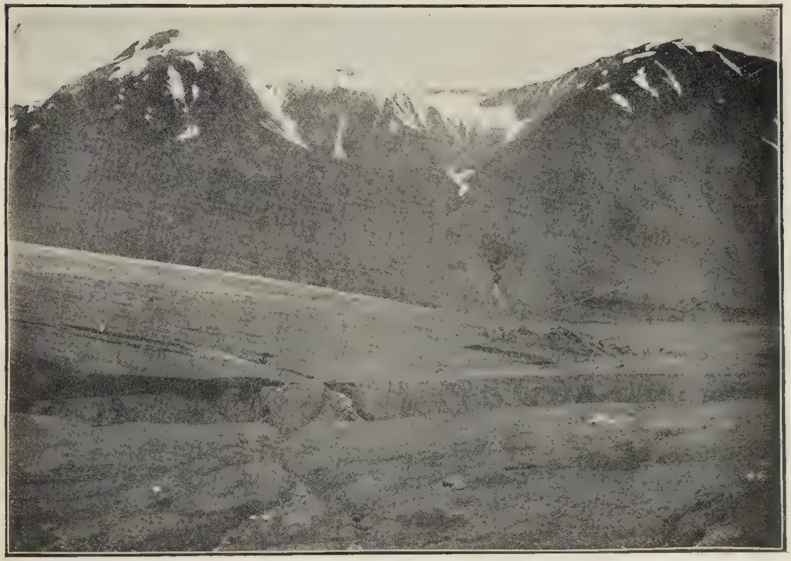

FIG. 12.—TERMINUS OF HIDDEN GLACIER, JULY 30, 1905, LOOKING SOUTHWARD. SHOWS ICE RESTING ON GRAVELS WHICH, FARTHER DOWN THE VALLEY, ARE DISTINCTLY OVERRIDDEN, ICE-ERODED AND MORAINE-VENEERED. IN THE MIDDLE OF THE PICTURE, NEAR THE MORAINE-VENEERED ICE MOUNDS, THE SNOUT OF THE GLACIER DESCENDS BENEATH THE OUTWASH GRAVELS. (FIG. 10.)

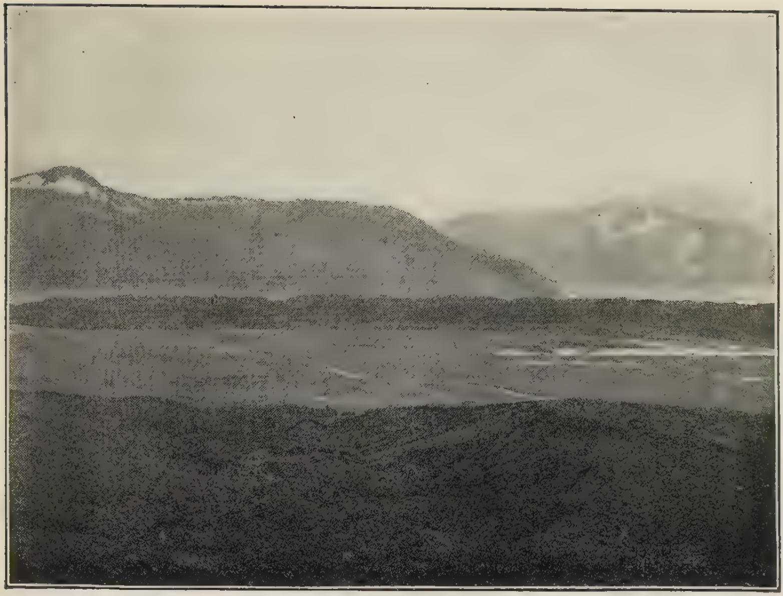

FIG. 5.—OUTWASH GRAVEL PLAIN BETWEEN MORAINE-COVERED ICE RIDGES, LOWER BULB-SHAPED END OF VARIEGATED GLACIER. VIEW TOWARD SOUTHWEST, FROM MORAINE-COVERED ICE, ACROSS GRAVEL FLAT TO MORAINE-COVERED ICE NEARER THE SEA, ENCLOSING THE GRAVEL FLAT IN A SWEEPING CURVE, CONCAVE TOWARDS THE GLACIER.

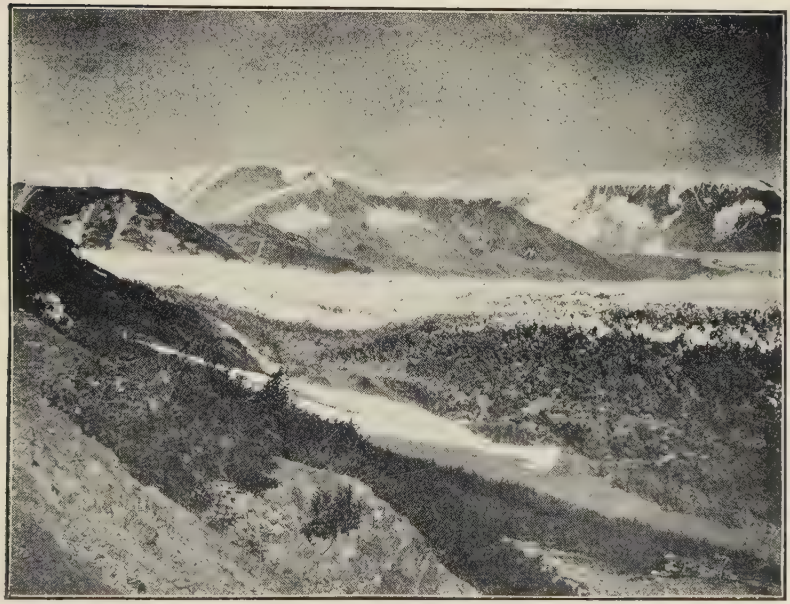

FIG. 6.—PROFILE OF LOWER END OF TURNER GLACIER FROM ELEVATION OF 525 FEET. VIEW LOOKS NORTH.

miliar among the deposits of continental glaciers. That a large mass of ice can be left in front of a receding glacier and be then protected from rapid melting by a veneer of outwash gravels has been inferred from a study of glacial phenomena; but here the process is actually visible. Among the interesting phenomena presented by this incipient pitted plain is the presence of ice directly connected with a living glacier yet not moved perceptibly by it. That the connection is complete is capable of proof by direct observation; and that the connection does not involve a marked forward thrust is proved by the undisturbed surface of the overlying gravel plain. Evidently the glacier terminus is itself nearly, if not quite, stagnant.

On the northern margin of the Hidden Glacier the ice is resting on a gravel deposit of earlier date, which it has overridden without removal (Fig. 12). This observation supplements that of Dr. Gilbert, who, in describing the same gravel deposit a half mile farther down the valley, called attention to the fact that it had been overridden. The proof of such former overriding is very clear both here and in other parts of the fiord, as will be shown under another heading. Thus the Hidden Glacier presents two interesting phenomena of opposite character—(1) the glacier is overriding earlier gravels on the north side, and (2) in the middle of its front is itself covered by gravels derived from its own melting.

MINOR GLACIERS.—A number of the smaller glaciers were studied; but the results of these observations will not be presented in detail here. One fact of general interest is illustrated by a large number of the smaller glaciers—namely, the great areas of morainic débris upon the lower ends. This moraine frequently covers the glacier from side to side and for a distance of from one to three miles from the terminus. Very often the moraine cover completely hides the ice, so that it is impossible to fix its exact terminus. But generally, even when the ice is not visible, its presence is indicated by the large quantity of water which emerges from the moraine as springs, and by the fissuring of the moraine, due to slumping as the ice is melted out from beneath it. Such moraine cover is usually associated with stagnant or nearly stagnant ice, and its presence is evidently an important factor in retarding the melting of the ice. On such moraines alders and willows frequently grow, sometimes forming thickets. Some of the alders are from fifteen to twenty years old, but more commonly they are less than five or six years.

This abundance of moraine is due in part to the friable nature of the weak rocks of the Yakutat Series, which are readily disrupted by frost action; but moraine-covered glaciers are also found among the crystalline rocks. Both here and in the glaciers among the weaker rocks an important cause for abundance of moraine is the form of the enclosing valleys, which have been over-deepened, and have had their sides greatly steepened by glacial erosion during a recent period of greater ice advance. This has given to the enclosing valley walls an unstable form, which yields readily to rapid weathering, and therefore tumbles great quantities of rock fragments down upon the glaciers.

The Black and Galiano Glaciers.—These two glaciers, on the west side near the head of Yakutat Bay, were photographed by Prof. Russell in 1890, and a comparison of the present conditions with those of 1890 reveals some astonishing facts. The Black Glacier has scarcely changed at all, and an examination of its front, with Russell's photograph in hand, from essentially the same site as that from which it was taken, showed changes of only minor degree. It still comes out to the end of its mountain valley and terminates in an abrupt ice-cliff without expansion, and is apparently in almost the exact position it occupied during Russell's visit. That it has not recently been more than 200 or 300 yards farther out is proved by the presence at that distance of a mature forest, while at a distance of 100 yards from the ice there is an alder growth with bushes from ten to fifteen years old.

Galiano Glacier, about two miles farther southwest, on the other hand, has undergone profound change. Russell's photographs show it as emerging from its mountain valley and spreading out fan-shaped on the plain between the mountains and the sea; and it still has this condition. But both Russell's description and his photographs show that this expanded, moraine-covered terminus was in 1890 covered with dense alder growth and some trees, whereas there are now no trees on it and only a few scattered alders five or six years of age. There are, however, numerous fallen trunks, and a large number of torn stumps standing upright on the face of the moraine-covered ice-front. The vegetation of Russell's day has evidently been destroyed by an advance of the ice.

Russell's photographs of this glacier reveal an extensive alluvial fan in front of it which no longer exists. In its place occur morainic hummocks through which the fan-building stream now flows, depositing its gravels among the hummocks. Concerning these facts the evidence is clear and convincing, but it has been found difficult to place upon them a satisfactory interpretation. Proper consideration of this problem would require more space than is here available. The problem is, why should two neighbouring glaciers show such different histories in a given time? And exactly what have been the changes on and in front of the Galiano Glacier? This problem will be discussed more fully in the final report of the expedition.

FALLEN GLACIER.—Photographs by both Russell and Gilbert, taken respectively in 1891 and 1899 from the summit of Haenke Island, show three small hanging glaciers in steep valleys on the west side of Disenchantment Bay, south of Turner Glacier. The southernmost of these glaciers was over a mile long, and its terminus about 1,000 feet above the water. On the third day of July we photographed this glacier from the fiord nearly opposite, and this proved to be the last day in its life. The next day at ten o'clock, when we were fortunately in Russell Fiord, about fifteen miles away, we were surprised by the appearance of a series of waves which rose on the shore fifteen to twenty feet vertically, and continued for nearly half an hour. Later we found that the glacier had slid bodily out of its valley and tumbled into Disenchantment Bay, leaving only a few small remnants clinging to the valley sides.

On visiting the valley later in the season the destruction performed by the glacial avalanche was found to be extensive, and the smoothed bed of the glacier was clearly revealed. Its fall caused a series of huge waves which rose on the coast nearby to a height of 110 feet, and on the north side of Haenke Island 115 feet (by Locke level), washing up and rending willows and alders at this elevation. At the point where we had photographed the glacier on the day before its fall the wave destroyed vegetation thirty feet above high tide. The Indians report that this same glacier slid out of its valley sixty years ago and killed a hundred Indians; but fortunately the Indians had left their summer sealing camp before July 4th, 1905, and no one was on Disenchantment Bay, otherwise there would certainly have been destruction of life.

RECENT RECESSION OF GLACIERS.—Most of the smaller glaciers studied show abundant evidence of recent recession, and it is evident that this shrinkage is still in progress. Unfortunately, we have no means of proving the exact amount or rate of this retreat, for in most cases there have been no previous records. The evidence of marked recession is, however, clear. It is in the form of moraine-covered ice remnants in front of the present ice termini (Fig. 22), and of barren areas in front of the ice, on which in some cases even annual plants have not yet taken root (Figs. 19 and 23).

For the larger glaciers the photographs by Russell and Gilbert and the maps by Gannett give us a basis for more exact comparison, and in some cases it was found possible to relocate the sites of the photographs taken by these observers. In the case of the Hidden Glacier the site of one of Gilbert's pictures was determined rather closely, though the exact spot could not be found.* Both by this and by a plane-table map the amount of recession of the snout of Hidden Glacier between June 1899 and July 1905 is found to have been about a quarter of a mile.

The exact site of Gilbert's photograph of the sea end of Nunatak Glacier was located, even the stones in the foreground being identical in the two cases. These two photographs are reproduced as Figs. 13 and 14. In this case the recession between 1899 and 1905 is not far from a mile. The land end of the Nunatak Glacier has receded between an eighth and a quarter of a mile since 1899, and the Cascading Glacier has diminished perceptibly.

RECENT ADVANCE OF TURNER AND HUBBARD GLACIERS.—Our photographs of the Turner and Hubbard Glaciers, taken from the sites of the photographs by Russell and Gilbert, were unfortunately not very successful, and our plane-table map does not definitely prove any change in the ice-front of these two glaciers. To show the present condition, marks were made on these earlier photographs while occupying the sites from which they were taken, and these show clearly a change in both glaciers. A comparison of our photographs with those of Russell and Gilbert shows fairly well the changes which we detected in the field.

In both of the earlier pictures the medial moraine in the ice-foot near the middle of Turner Glacier appears to turn northeastward; but in 1905 this turn is gone, and the much-shortened medial moraine advances straight into the fiord. This is taken as an indication that the sea front of Turner Glacier was in 1905 several hundred yards farther back than in either 1891 or 1899. This recession may possibly be related in origin to the violent earthquake of September, 1899, which is known to have profoundly affected the Muir Glacier, and whose effects in this fiord were stupendous, as will be shown in other papers. As compared with Russell's photograph of 1891, the two ends (north and south) of Turner Glacier front had in 1905 receded perceptibly; but as compared with Gilbert's photograph of 1899, the two ends have advanced slightly. The evidence, therefore, indicates for this glacier a general recession between 1891 and 1899 and a slight advance on the two ends between 1899 and 1905, but a recession in the centre.

A photograph taken in 1899 by Gilbert, on the south side of Hubbard Glacier, looking along the front of the ice-cliff, was dupli-

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* See Fig. 15 and compare with Gilbert's picture in Harriman Alaska Expedition, Vol. III, Plate VI.

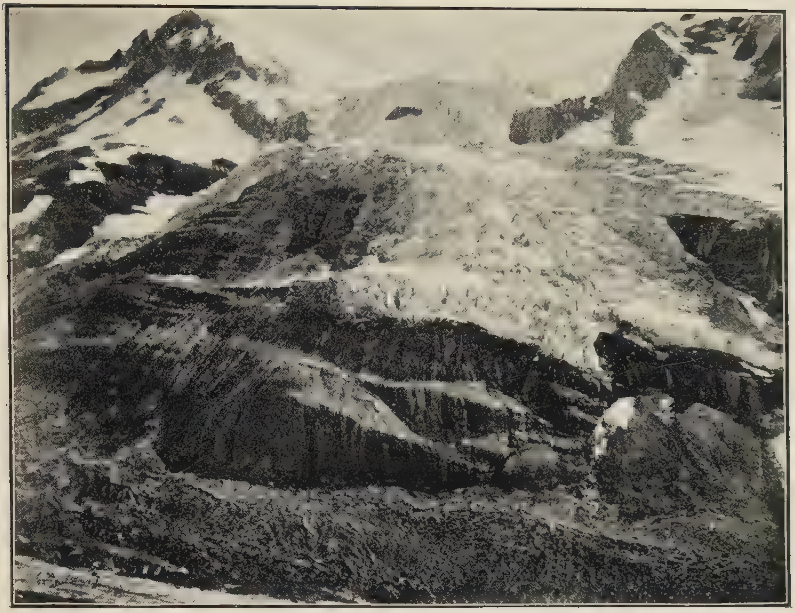

FIG. 9.—CASCADING GLACIER, JULY 24, 1905, FROM SOUTH SLOPE OF GANNETT NUNATAK, LOOKING SOUTHWARD. SHOWS STRONG GROOVING OF VALLEY SIDE, AND CASCADING GLACIER ISSUING FROM ITS HANGING VALLEY AND DESCENDING THE TERRACES. THE VERTICAL BANDS ARE THE RESULT OF STREAMS FLOWING DOWN THE CLIFF SIDE FROM THE GLACIER.

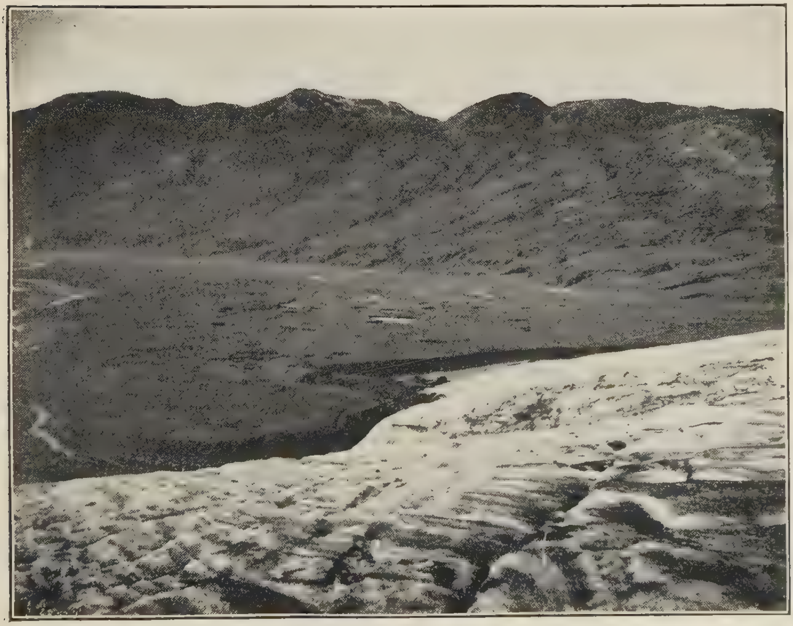

FIG. 10.—PITTED OUTWASH PLAIN BELOW END OF HIDDEN GLACIER. VIEW LOOKS NORTHWESTWARD. CAMERA STANDS ON HIDDEN GLACIER. GLACIATED TOPOGRAPHY AND ABSENCE OF VEGETATION ARE NOTABLE. VIEW TAKEN JULY 25, 1905.

cated as nearly as possible in 1905; but Gilbert's exact site could not be found. From this station it appears that the ice has receded, but the correctness of this conclusion is rendered uncertain because of doubt as to the exact location of Gilbert's picture. We could not, however, find any spot as near the ice as Gilbert's picture, and with the proper relation of beach to ice, where anything but recession could be inferred. On the other hand, from the Gilbert and Russell sites on Haenke Island, and from Gilbert's site on Gilbert Point* above Osier Island, it is evident that the northwest half of Hubbard Glacier has advanced between 1899 and 1905, though the exact amount cannot be stated. The evidence of this advance is that the northwestern end of the glacier on the land is farther out, and the medial moraine of the western tributary of the Hubbard Glacier now bends farther southward than in either 1891 or 1899. This suggests the possibility that the western arm of the Hubbard is advancing and the eastern receding.

One of our Indians, who hunts seal in the bay each year, was very confident that the Hubbard Glacier has been advancing for the last ten or twelve years; but our plane-table map, as compared with that of Gannett, does not support this view. However, with a short baseline, and with the great distance to the various points on the glaciers, small changes might not appear. Our study of the photographs made by Gilbert and Russell convinced us that there has been an advance of the northwestern part of the Hubbard Glacier, both as compared with the photographs of 1891 and with those of 1899. Our photographs will be published in the final report, where this subject is more fully discussed.

FORMER EXTENSION OF GLACIERS.

That the glaciers of this region have at one time been much more extensive, and in fact have occupied the entire inlet, is clearly demonstrated by three important lines of evidence: (1) The Yakutat foreland; (2) the presence of high-level moraines on the mountain slopes; and (3) the evidence of profound glacial erosion. Each of these lines of evidence will be briefly considered.

These former greater ice streams will be spoken of as the Yakutat Bay Glacier and the Russell Fiord Glacier.

THE YAKUTAT FORELAND.—This broad foreland is so densely wooded over part of its area, especially near the shores, that its exploration is difficult. We entered it a short distance at several points, and at Yakutat went out upon it for about ten miles to the terminus of the Yakutat and Southern Railway. From the slopes of Mt. Tebenkof we gained, also, a good bird's-eye view of the foreland. From these examinations it was found that the foreland consists of two quite different classes of deposits. Near the shores of Yakutat Bay and south of the head of Russell Fiord it is distinctly morainic, with hummocks and kettles, some of them occupied by lakes and swamps. In this part of the foreland there are quantities of large crystalline boulders, evidently brought from far back in the St. Elias chain. Fringing these moraines to the south and east is a level plain, or prairie, free from forest over a great part of its area because the drainage is too slack for tree growth. This plain, sloping gently seaward, is made of outwash gravels, evidently of the same origin and general character as those now building along the margin of the Malaspina Glacier.

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* Named for Dr. G. K. Gilbert.

The evidence from the foreland points to the presence of moraine-building ice, filling both Russell Fiord to its head and Yakutat Bay clear to Yakutat, and building up the area intervening between the ends of the two glaciers with outwash gravels from each of the great glaciers. That during this expansion of the glaciers ice extended out to the present mouth of Yakutat Bay is indicated by the soundings, which show a general though irregular rise in the bottom of the bay from its head, where it is 1,000 feet deep, to its mouth, where the water is everywhere shallow, being nowhere over 100 feet deep and over most of the distance from 50 to 75 feet deep. This shoal forms a definite, narrow ridge completely across the mouth of Yakutat Bay. Just inside of the ridge the water rapidly deepens.

Exactly what relation this expanded Yakutat Bay Glacier bore to the Malaspina is not now clear. That the two must have coalesced is evident; and that the Malaspina Glacier dominated in the lower part of the bay is indicated by the west-facing, irregular coast of the eastern side of the bay and its series of islands. If the sea was then at its present level there must have been a continuous ice-cliff across the site of the present mouth of Yakutat Bay, and far to the westward along the front of the present Malaspina. Whether the Yakutat Foreland was begun as a deposit in the sea is not now certain; but it is clear that it was finished above sea-level, and apparently approximately at the present level. This conclusion is based upon the fact that so much of its surface is alluvial fan, which could have been made only above sea-level. That before the advance of the ice the foreland was higher than now is proved by the presence of submerged forests on the beach beneath the gravels of the foreland at the head of Russell Fiord.

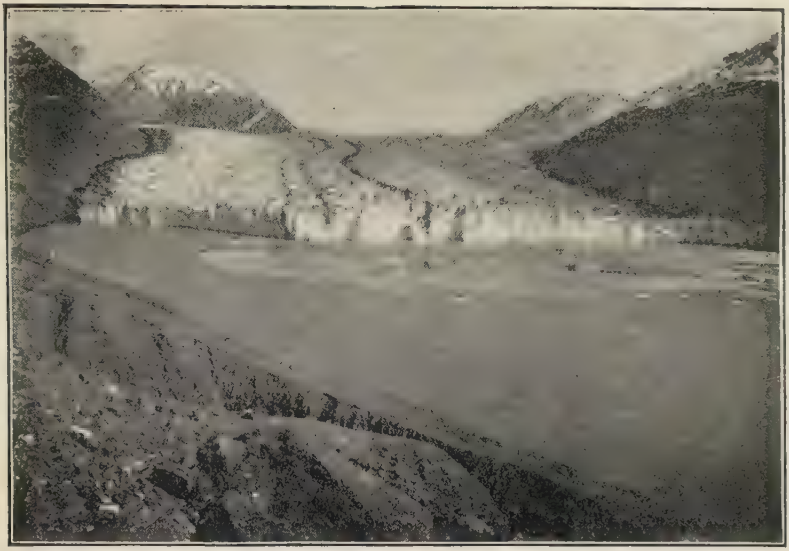

FIG. 7.—NUNATAK GLACIER (SEA END) FROM THE NORTH SIDE OF THE FIORD. SHOWS THE THROUGH-GLACIER CONDITION OF THE SOUTH ARM. GANNETT NUNATAK ON THE RIGHT.

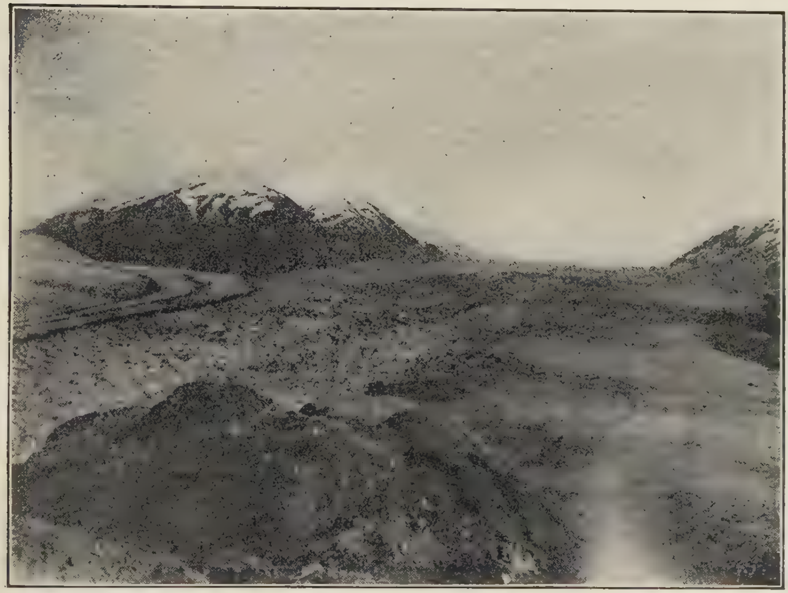

FIG. 8.—NUNATAK GLACIER FROM CREST OF GANNETT NUNATAK AT ELEVATION OF 1,400 FEET. SHOWS THROUGH-GLACIER CONDITION OF SOUTH ARM OF NUNATAK GLACIER.

An interesting record of the termination of the expanded Russell Fiord Glacier is preserved in the fist-shaped expansion, outside the mountains, that constitutes the head of the inlet. Evidently the Russell Fiord Glacier had a bulb terminal where released from the confining walls of the mountain fiord, and water now occupies the area formerly filled with ice at the stage of the glacier's maximum extension.

HIGH-LEVEL MORAINES.—Moraine deposits and foreign rock fragments occur at various points on the mountainous slopes of the fiord, proving the former presence of ice at these elevations. At four points we determined as carefully as possible, by the use of the aneroid barometer, the elevation to which the ice formerly reached, [illegible] careful to select places where the complication of local valley [illegible] could not enter.

The first of these was on the ridge west of Cape Enchantment, which rises over 3,000 feet above Russell Fiord. Here excellent moraine occurs up to 1,350 feet, and crystalline rocks, undoubtedly brought from outside the peninsula, at 2,000 feet. Glacial scratches were observed at an elevation of 2,700 feet; but since above 2,000 feet there were no rocks that could be proved to be foreign this is taken as the elevation to which the ice-flood rose at that point.

The second point selected was on the ridge south of Point La Touche at the entrance to Disenchantment Bay. Here an excellent moraine occurs at an elevation of 1,750 feet, and foreign boulders at 1,920 feet. In the bay a mile or two west of this there is a sounding of 167 fathoms, so that at this point, at the very head of Yakutat Bay proper, the ice was at least 2,920 feet thick.

Northwest of Point La Touche, on the west side of the head of Yakutat Bay, the third point examined, there is a perfect moraine terrace which has an elevation of 1,900 feet where developed on the mountain side above the Galiano Glacier, but descends to 1,675 feet in two or three miles toward the southwest—that is, toward the Malaspina Glacier.

This height of the ice would permit the Yakutat Bay Glacier, extending out of Disenchantment Bay, to pass through some of the low divides of Puget peninsula to join the Russell Fiord Glacier; and it is probable, also, that during this higher stage of the ice the glacier streamed across the divide between the Hidden and Nunatak valleys and the Alsek River valley. The ice-divides at the present time are put down on the Boundary Commission map as 3,000 feet, and this is, of course, much higher than the rock-divide. Moreover, the elevation of the ice in Russell Fiord (2,000 feet) is too far down the fiord to represent its maximum elevation. In view of these facts, it seems probable that the ice currents readily passed across these low divides.

The fourth point where the elevation of the ice in its flood stage was measured is on the southwestern slope of Mt. Tebenkof, just east of Knight Island. Here a pronounced moraine terrace occurs at an elevation of 800 feet, and foreign fragments were found up to 1,060 feet. This point is directly above the Yakutat Foreland and about fifteen miles from the outermost moraine of the foreland near Yakutat.

Glacial Erosion.—The evidence of profound glacial erosion in this fiord is clear and convincing. On the east shore of Yakutat Bay, where the valley broadens rapidly, this evidence is not very strong; and near the head of Russell Fiord, toward the end of the tongue which filled that valley, so far as can be judged from the character of the valley sides, there was evidently little glacial erosion. But in Disenchantment Bay, most of Russell Fiord, Nunatak Fiord, and many minor valleys, the evidence of ice erosion is of the most definite character. Its clearness is rendered all the more striking because of the almost complete absence of vegetation, and the general thinness of drift (Figs. 15 and 16).

One is prepared for a belief in vigorous ice erosion by the prominence of striated rock surfaces and *roches moutonnées* forms on the fiord walls. This erosion often assumes the form of a distinct grooving, by which the valley walls are sculptured nearly horizontally into terrace-like steps descending gently in the direction of ice motion. This sculpturing is at times coincident with differences in rock texture, but is often independent of it. The photograph of the Cascading Glacier (Fig. 9) well illustrates this type of sculpturing. There is terrace above terrace carved in the rock wall of Nunatak Fiord when the greater glacier flowed out of it at the time of a higher stand of the ice. The Cascading Glacier descends from terrace to terrace, with direction of flow at right angles to that of the former ice-tongue whose groovings it has been incompetent to destroy. So recent has been the last stage in this erosion of the Nunatak valley that near the glaciers the rock surfaces a thousand feet above the fiord are smoothed and striated, and glisten in the sun as their polished faces reflect the sunlight.

Where the rocks are fairly firm, but much jointed, notably in the granite cliffs on the south shore of Nunatak Fiord, the evidence of plucking is very pronounced. In such places the rock cliffs are rough and hackly as a whole, but in detail are found to consist of a

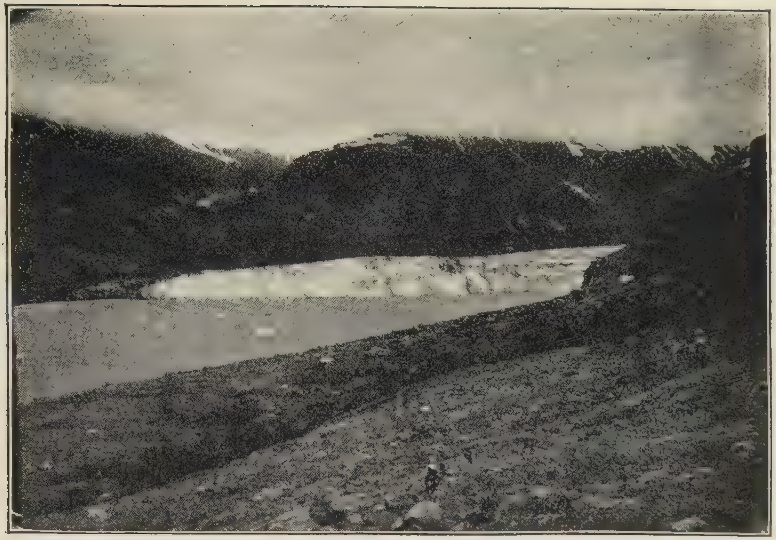

FIG. 13.—GILBERT'S PHOTOGRAPH OF NUNATAK GLACIER, JUNE 21, 1899. COMPARE WITH PHOTOGRAPH JULY 24, 1905. (FIG. 14.)

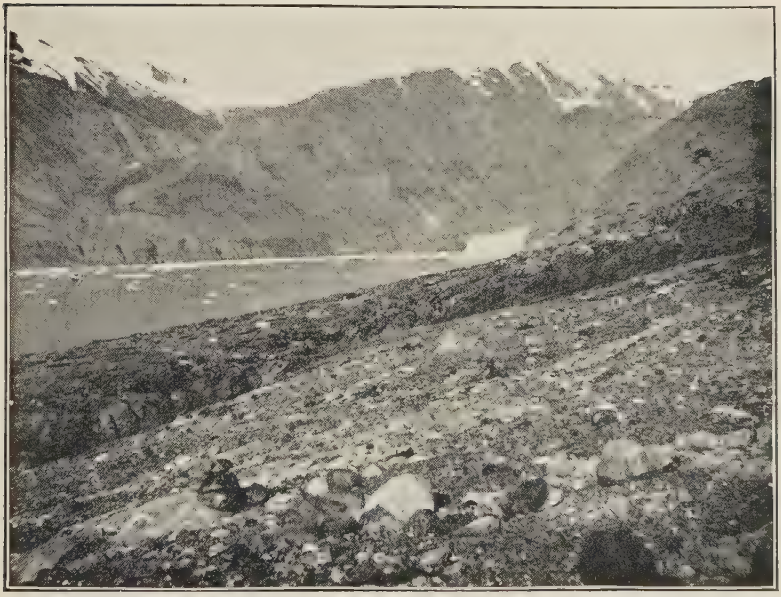

FIG. 14.—NUNATAK GLACIER, JULY 24, 1905. TAKEN FROM EXACT SITE OF GILBERT'S PHOTOGRAPH, JUNE 21, 1899. THE SAME BOULDERS APPEAR IN BOTH PICTURES. COMPARE WITH FIG. 13.

The resistance of the rock is another factor of importance; and it is a notable fact in this connection that the valleys hanging highest above the sides of the fiord are in the region of crystalline rocks, while those entering the fiord in the weaker Yakutat Series are hanging at much lower levels. As would be expected as a result of differential ice erosion, there is every gradation from the high hanging valleys to those with lips at or below the fiord-level; and the larger valleys admit the sea into their mouths, as in the case of Seal Bay and Nunatak Fiord. It is to be expected that these will also be found to be hanging above the fiord bottom when soundings have been made.

The proof that hanging valleys in glaciated regions are significant of ice erosion is now so well established that it is hardly necessary at this time to consider the question whether these phenomena in the Yakutat Bay region may be due to another cause than ice erosion. The facts all harmonize with the explanation of ice erosion, and are totally out of harmony with any other explanation that has so far been proposed. Even with the clear evidence presented in this region that as late as 1899 faulting has occurred along the axes of some of the valleys, the hypothesis that the hanging valley condition is the result of faulting seems absolutely untenable. It could not account for the difference in level of neighbouring hanging valleys; for the hanging tributaries of main hanging valleys whose rock lips show no signs of faulting; for the residual nunatak knobs on the sides and in the middle of the fiords; nor the flaring fiord walls.

The peculiar condition of lowered divides, common in Puget Peninsula and between Russell Fiord and the Alsek River valley, which makes possible the presence of through-glaciers in these situations, is interpreted as the result of the reduction of divides by ice erosion when the glaciers were of greater extension, and therefore able to stream across the lower divides. Such broad, transverse valleys in the midst of a rugged mountain region seem out of harmony with the rest of the topography, and with the dominant direction of drainage. Some of the lower through-valleys near the fiord, in which there is little or no ice at present, show evidence of vigorous ice-erosion; but the larger ones are still so deeply buried beneath ice that their characteristics are in large part obscured. Their lack of harmony with the erosional forms of the surrounding mountains proves that they are not wholly the result of subaerial erosion; the theory of block faulting is wholly gratuitous, and, in the case of the visible through-valleys, evidently not applicable. To the ice-erosion theory no strong objection appears, and it is therefore proposed in explanation of this phenomenon.

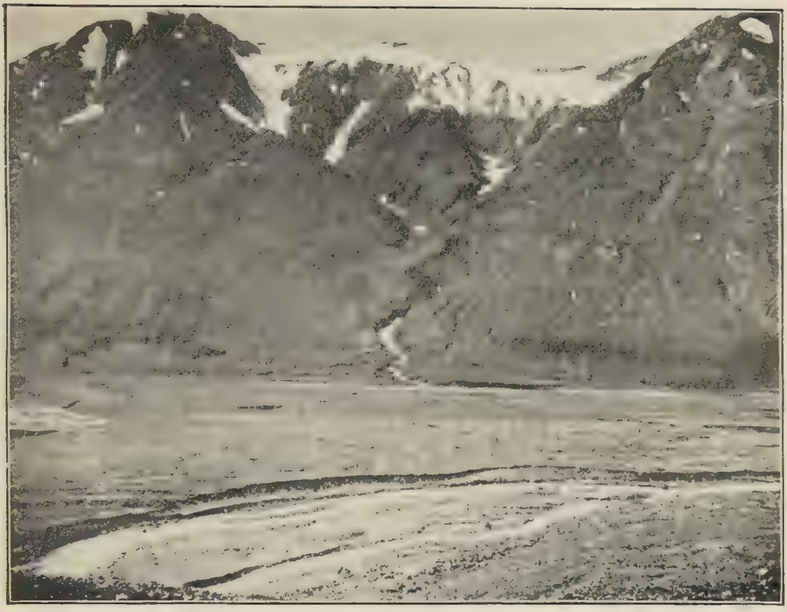

FIG. 15.—LOOKING SOUTHWARD ACROSS HIDDEN GLACIER VALLEY, JULY 26, 1905, SHOWING EXTREME END OF FRONT OF GLACIER ON THE LEFT. COMPARE WITH GILBERT'S PICTURE (HARRIMAN EXPEDITION, VOL. III, PL. VI) TAKEN FROM NEARLY THE SAME SITE, BUT A LITTLE FARTHER BACK. SHOWS A BROAD MOUNTAIN VALLEY TERMINATING BELOW IN A GORGE.

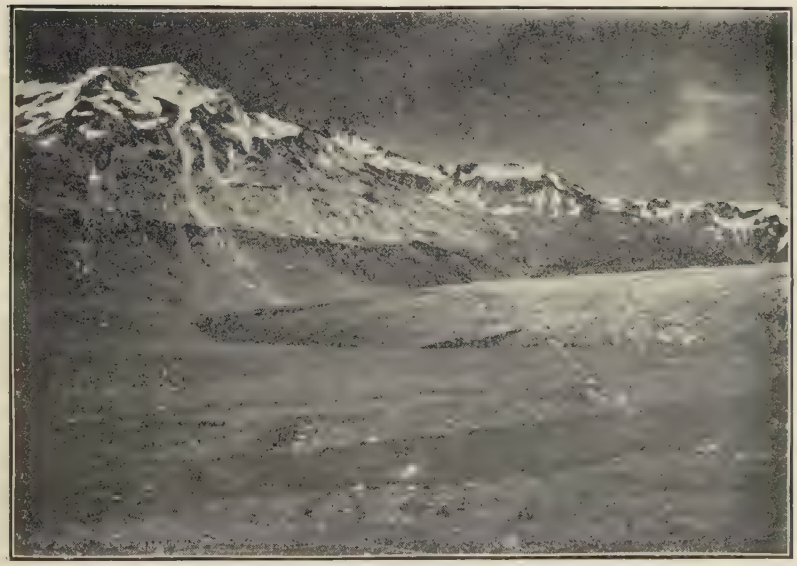

FIG. 16.—TERMINUS OF HIDDEN GLACIER, JULY 25, 1905, LOOKING NORTHEASTWARD FROM A SMALL ROCK KNOLL RISING ABOVE GRAVEL PLAIN ON SOUTH SIDE OF VALLEY. SHOWS THE GRAVEL PLAIN BENEATH WHICH THE ICE DESCENDS; AND THE OLDER GRAVELS ON THE NORTH SIDE ON WHICH THE ICE NOW RESTS; ALSO STRONGLY GLACIATED TOPOGRAPHY AND ABSENCE OF VEGETATION.

EVIDENCE OF INTERGLACIAL STAGE.

GRAVEL DEPOSITS.—Along the shores of various parts of the inlet there are gravel deposits forming low, irregular terraces. It is not certain that they are all of a single age, but they all have the same characteristic*; and they occur all the way from the foreland up to and under some of the glaciers, notably the Hidden Glacier (Fig. 12). These gravels lie for the most part within one or two hundred feet of sea-level. Viewed at a distance, and in general, they often assume the form of terraces (Fig. 19); but when looked at in detail they are found to be undulating and not of a uniform level. Evidence is presented below to show that they are remnants of more extensive gravel deposits overridden by ice after their accumulation and partly removed by the ice-erosion. They bear no recognizable relation to existing sources of gravel, not being, for example, better developed opposite large streams. Their most typical development is in the south arm of Russell Fiord, and there they rise to a level rarely higher than 250 feet. The larger remnants occur in places where the topography suggests the possibility of weaker ice-erosion than in places where they are entirely absent.

Numerous cuts, both by streams and waves, clearly reveal the composition of the gravels in many places. They consist of cross-bedded gravels (Fig. 20) with many sand layers and occasional beds of clay, and the general dip of the layers is toward the fiord; but in many cases it is along the axis of the fiord and downward away from the ice source. The pebbles are in the main of crystalline rocks, well rounded, both of which facts indicate long transportation. They are strikingly unlike the gravels of the alluvial fans now forming near them, in which the pebbles are prevailingly of local Yakutat Series rocks and only slightly rounded. In the gravels are numerous large boulders, which must have been drifted to their place in floating ice. No animal fossils were found in the clays.

Evidently these gravels were deposited in a former, higher water body, in which ice could float boulders hundreds of pounds, and in some cases tons, in weight. Such a water body must have existed in Russell Fiord when the glaciers advanced far enough to cut it off from Disenchantment Bay, as explorations over 100 years ago indicate they did; smaller bodies of water marginal to the ice may also have existed here and in other parts of the bay. Into these water bodies glacial streams apparently built outwash gravel deposits as the ice was receding from its former maximum advance. That the period of their building was not long ago is proved by the fact that the gravels are not at all disintegrated.

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* There are also higher level gravels not considered here.

The period of gravel-building evidently lasted a long time, and under conditions different from the present, for in the gravels are frequently found fragments of trees in a region where no trees now grow. Most of these trunks are recumbent, but in one place they are standing where they grew (Fig. 21), buried in the gravels. In this case the trees were mature in age, their bark was preserved, and cones occurred in the clay layers in which the trees grew. One recumbent log was found in the gravel terrace of the Hidden Glacier valley, about a mile from the present ice terminus, and fully twenty miles from the nearest trees at present growing in the fiord. Our collections of wood have not yet been identified, so that it is impossible at present to tell the nature of this forest growth. It indicates, however, a long period for the formation of the gravel deposits, and the presence of conditions favouring tree growth in a region where no trees now grow. The variation of conditions which caused first coarse gravel deposition, then tree growth to maturity, then re-establishment of conditions of gravel deposition, is indicated in the present alluvial fan of Atrevida Glacier, where fluctuation of stream course and of load are to-day resulting in clay deposit in one place, and in another, the burial of a living forest, while near-by a degrading stream is uncovering a forest previously buried.

Some of the recumbent trees may have been brought to their position by the ice of the maximum advance and therefore represent a part of the preglacial forest, though this does not seem probable in view of the evidence of marked ice-erosion, which should have removed the forest and carried its remnants out to the moraine of the foreland. Moreover, the abundance of these recumbent logs seems too great for this explanation. Wave dissection is now carrying off the logs of these buried forests, and they are being built into driftwood piles on the beaches. This is well seen at the head of the bay, where no modern forests of mature growth are reached by the waves. Consequently one's camp fires are fed by the wood of the last interglacial epoch before the present.

RE-ADVANCE OF THE ICE.—A number of facts prove that these gravels have been overridden by a glacier since their deposit. In the first place, as has been already stated, the gravels extend up to some of the glaciers, and in at least two cases the ice rests directly on the gravels. The best instance of this is at the Hidden Glacier (Fig. 12), already described; but a valley glacier on Puget peninsula just southwest of Cape Enchantment has also overridden its gravels (Fig.

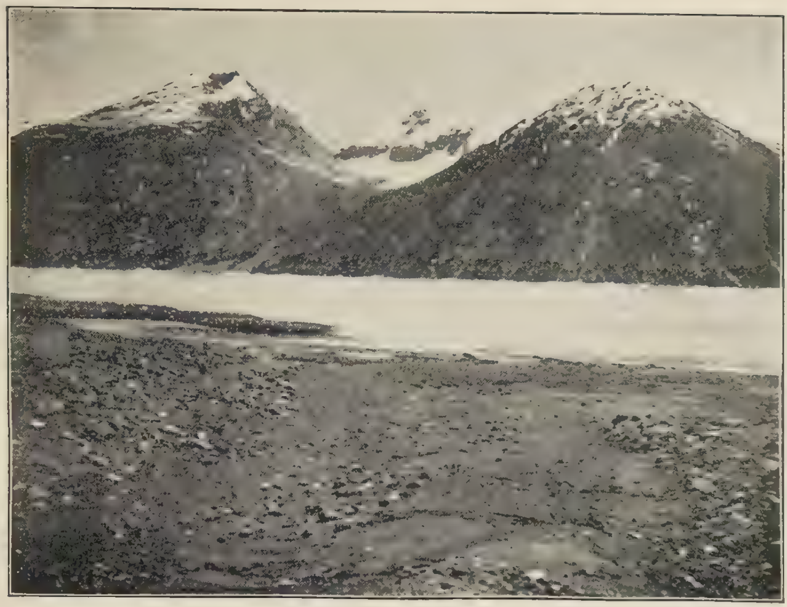

FIG. 17.—HANGING VALLEY ON SOUTH SIDE OF NUNATAK FIORD. VIEW LOOKS SOUTHWARD STRONGLY GLACIATED SLOPES, RECENTLY ABANDONED BY ICE AND WITH ALMOST NO VEGETATION.

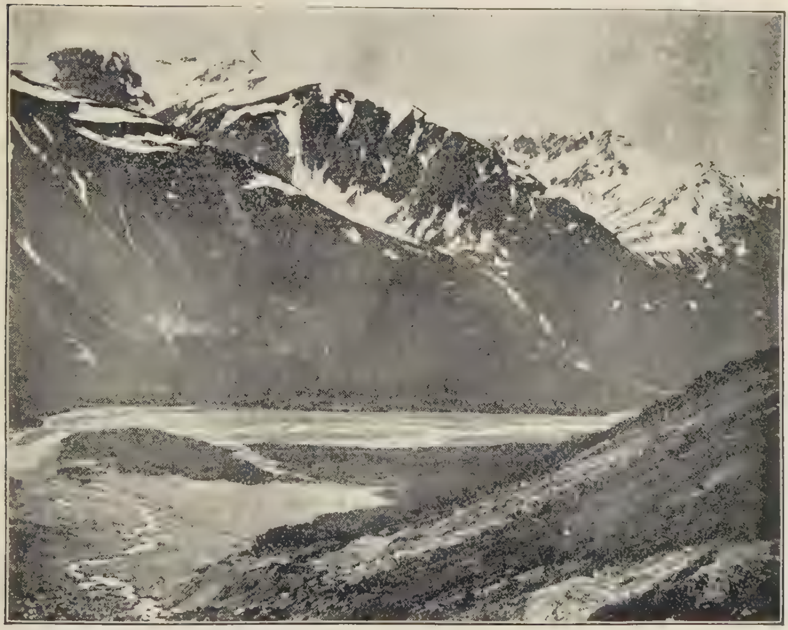

FIG. 18.—HANGING VALLEYS ON NORTH SIDE OF THE BROAD U-SHAPED GLACIATED RUSSELL VALLEY ON PUGET PENINSULA. VIEW LOOKS NORTHEASTWARD UP THE VALLEY. THE VALLEY BOTTOM IS LEVELLED BY OUTWASH GRAVELS DERIVED FROM A SMALL GLACIER AT THE HEAD OF THE VALLEY, ONE OF WHOSE RECESSIONAL MORAINES APPEARS IN THE LEFT CENTER.

22); and in other cases the same condition is apparently present, though the evidence is not quite so clear.

A second proof of overriding of the gravels is the topography of the terraces. Being water-laid gravels, their constructional surface must have been a plain, determined by the water surface into which they were built and by the stream grade which was supplying the gravels. They no longer have the form of a plain, but have instead a gently-rolling surface which truncates the gravel layers. Some erosive force has removed a part of the gravels. It is not wave action, which would have cut a terrace; nor is it stream erosion, which would have cut gorges down toward a base-level. The erosive force has given the surface of the gravels an undulating outline, often broadly grooved parallel to the axis of the valley, and hence at right angles to the direction in which stream erosion would dissect them. The surface form has the appearance of an ice-eroded surface, and many miles away from the present termini of the glaciers is identical with that of the gravels of the Hidden Glacier valley, from which the ice is known to have retreated within the past six years.

Associated with this ice-erosion topography is a veneer of moraine resting on the surface of the gravels. In places the moraine is represented only by scattered boulders; but very frequently there are morainic hummocks and ridges, often enclosing kettles in which at times ponds are held (Fig. 24). Where best developed the gravel deposits have the appearance of a very thick moraine; but stream and wave cuts prove that even there the condition is really that of thick, eroded gravel beds with a thin morainic veneer. The morainic forms present some very interesting characteristics, one of the most notable being the linear disposition of assorted boulders and of moraines, resulting, evidently, from accumulation in crevasses during the final melting of the ice. There are also kame areas, and occasional eskers of small size resting on the gravels (Fig. 23).

That the gravels have been overridden by ice admits of no doubt; but the overriding did not extend the whole length of the fiord. In the southern half of the south arm of Russell Fiord the gravels have a level surface up to an elevation of about 140 feet, and on it there was found no evidence of overriding either in the form of ice-eroded surface or of moraine veneer. Above the level of 140 feet the surface is of a pronounced moraine. It is therefore inferred that the re-advance of the ice extended about half way to the head of the southeastern arm of Russell Fiord, and that the waves of an [illegible]mmed lake, held up in the southern part of the fiord, formed [illegible] avel bench which exists there at an elevation of about 140 fe[illegible] planing off the morainic deposits.

For the phenomena described in this and the preceding section two possible interpretations present themselves: (1) The advancing glaciers of the great ice flood made the gravel deposits, then overrode them, but failed to remove them; (2) the recession of the great ice advance, or a recent re-advance, or both, were accompanied by gravel deposit, and the re-advance overrode a part of the gravels, but did not last long enough to completely remove them. Unfortunately, the platform on which the gravels rest was nowhere seen, so that direct evidence from this source is not available. The reason for considering the first explanation impossible is indirect, but seems to the authors convincing. It is that, if the gravels were formed in front of the ice in the main period of advance and then overridden by it, they must surely have been removed by erosion. If our conclusion that there has been profound ice-erosion in the fiords is correct, the extensive gravel deposits surely could not be left where they now stand. Some of them in Nunatak Fiord lie directly beneath the lip of a hanging valley; and others in Russell Fiord extend across the mouth of a hanging valley. Even without the assumption of such profound ice-erosion as is believed to have been accomplished in this region, it seems inconceivable that ice over 2,000 feet thick, and 25 miles from its terminus, could have passed over gravels for a long enough time to build the great Yakutat Foreland and yet not remove a series of gravels, especially in view of the scratched, grooved and plucked rock cliffs, indicating that the ice was a powerful erosive agent. The wonder is that even a brief advance of the ice, extending part way through the fiord, should have left such extensive accumulations of gravel. But this is not the only region where the evidence indicates earlier powerful glacial erosion and later weaker advance failing to remove gravel and even products of residual decay.

This evidence, though indirect, is therefore advanced as proof that the gravels were formed subsequent to the great ice advance, and that they were very recently overridden by another advance which extended part way through the fiord but did not last long enough to erode the gravels formed at an earlier stage. That the recession of the ice from these gravels, now actively in progress, is very recent is indicated by the vegetation, as stated below. Without much doubt this advance was the one which stopped the explorations of Malaspina in 1792 and Puget in 1794, when they found Disenchantment Bay blocked by ice down as far as Haenke Island.*

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* It is noteworthy that the succession worked out in the Yakutat Bay region is almost identical with that demonstrated for the Muir Inlet region by Wright, Reid, and Cushing.

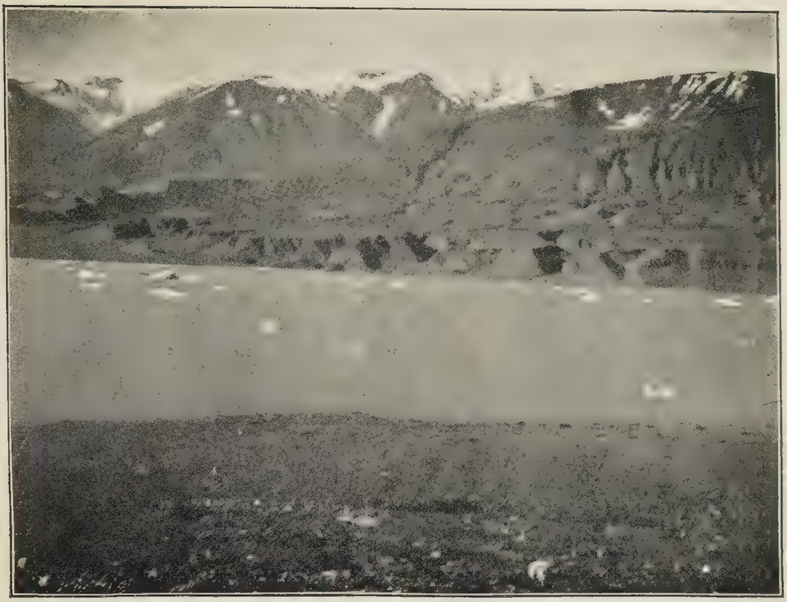

FIG. 19.—DISSECTED GRAVEL TERRACES ON THE NORTH SIDE OF NUNATAK FIORD, ABOUT TWO MILES BELOW THE SEA END OF NUNATAK GLACIER. THESE GRAVELS HAVE BEEN OVERRIDDEN BY THE ICE AND BEAR A VENEER OF MORAINE. VEGETATION HAS NOT YET OCCUPIED THEM.

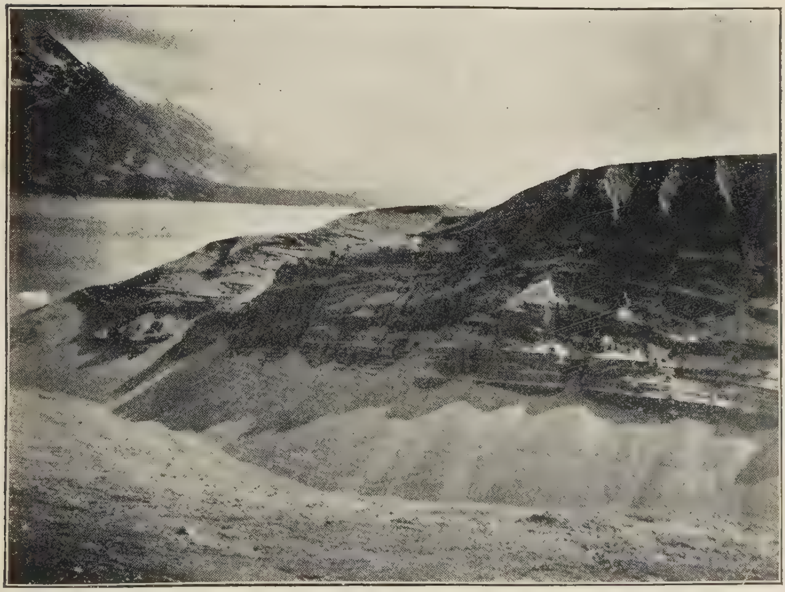

FIG. 20.—SECTION IN THE OVERRIDDEN, MORAINE-VENEERED GRAVELS ON THE WEST SIDE OF THE SOUTH ARM OF RUSSELL FIORD. VIEW LOOKS SOUTHWARD AND IN THE DISTANCE SHOWS THE OVERRIDDEN GRAVEL AREA ON THE EAST SIDE OF THE FIORD, JUST NORTH OF RUSSELL COVE. (SEE ALSO FIG. 24.) ONLY SCATTERED ALDERS AND OPEN THICKETS HAVE ADVANCED THUS FAR NORTHWARD.

ADVANCING VEGETATION OF YAKUTAT BAY.—In 1892 Funston collected plants in Yakutat Bay up as far as Haenke Island; but no detailed botanical study, so far as known, has been made beyond this point. In variety of species present the region is not an inviting one, but in distribution of plants the field is most attractive; for it is a region from which the ice is even now receding, and in which one may note the advance of a flora upon a land newly opened to plant occupation by ice withdrawal. Unfortunately, none of our party was trained as a botanist, and other duties prevented the collection of plants; but some general features were so noticeable that they could not escape attention.

The Yakutat Bay region presents two entirely opposite conditions of vegetation. On the one extreme is the typical dense Alaskan forest; on the other, a desert (Figs. 16, 19, and others). The forest clothes the foreland and the lower mountain slopes at the head of Russell Fiord and on the border of Yakutat Bay. In the damp, equable climate the vegetation grows luxuriantly and the forest is dark, damp, and difficult to penetrate. It is mainly of Sitka spruce, with individuals 70 feet high. Much less abundant is the hemlock. In favourable situations the cottonwood grows, in places forming forests, with little or no spruce in it. According to Funston, the spruce rises to an altitude of 2,200 feet on the sides of Mt. Tebenkof; but the timber-line descends toward the interior, reaching sea-level in Disenchantment Bay. In the narrower Russell Fiord the forest reaches less than half way northward from the head of the inlet toward Cape Enchantment.

Between the forest and the desert there is an area occupied by alder and willow, which grow in such an intricate tangle as to make passage a most difficult task, rendered exasperating by the presence of the thorny devil's club. The same type of growth occurs on the mountain slopes above the forest zone. This alder tangle occurs in many valleys of the peninsula, along both shores of Russell Fiord just north of the forest zone, along the shores of Disenchantment Bay, and in a part of the stretch of Russell Fiord between Gilbert Point and Cape Enchantment. It is absent from Nunatak Fiord, and from most of Russell Fiord between Marble Point and Seal Bay.

The desert is in part the result of rugged mountain, snowfield, and ice conditions; in part it is caused by the presence of moraine-veneered ice with a shifting soil, and of alluvial fans now building; but over large areas the desert condition is due to the fact that ice has so recently left the land that woody plants have not found time to occupy the soil. This is especially true between Marble Point and

Seal Bay, including Nunatak Fiord (Figs. 17 and 19). Here the alder and willow have begun to grow, but, excepting in a few spots, have not succeeded in developing the characteristic, almost impenetrable thicket. Nearest to the ice of the Nunatak and Hidden Glaciers no alders or willows grow, but between the glaciers and the area of alder thickets are individuals and clusters, increasing both in size and abundance away from the ice.

There can be no question that vegetation is following up the receding ice, and that its stages of advance are here plainly recorded. The ice is receding faster than vegetation can advance, and light-seeded alders and willows have pushed farthest forward. That the forest trees have not advanced as far as is possible under existing climatic conditions, and that the forest is now marching toward and into the desert area, is indicated by a number of facts. In the first place, the climate is apparently favourable. We have not climatic data to prove this beyond question; but the summer from the first of July to the first of September is certainly favourable; and, even with the neighbourhood of glaciers and snow-clad mountains, it seems improbable that the winter cold here can be too severe for trees, for the area is near the warm ocean, open to its influence, and is bathed by fiord waters. In the second place, the limit of tree growth is not marked by stunted trees, as is the upper limit of tree growth on the mountains. Well-formed and good-sized spruces and cottonwoods mark the northern limit of the forest, which could hardly be the case with a forest limited by adverse conditions. Furthermore, the light-seeded cottonwood is in advance of the heavy-seeded spruce. Finally, both spruce and cottonwood in scattered individuals occur well in advance of the forest. Scattered young cottonwoods occur within a few miles of the present terminus of the Nunatak Glacier, and there are two or three young spruces, estimated to be fifteen or twenty years old, growing on Haenke Island. Funston in 1892 reported that there were no spruces in Disenchantment Bay; but in 1905 there certainly were several spruces as far up this bay as Haenke Island.

There is in this bay a splendid chance for an interesting ecological study; and it ought to be made now, for purposes of comparison at some future time. Not only is there this general problem, but also the very interesting phenomenon of the growth of vegetation on the moraines of living ice.

THE FAUNA OF YAKUTAT BAY.—No attempt was made to study the fauna of the region, and it is not the purpose here to give a list of even those animals observed, but merely to point out the evidence

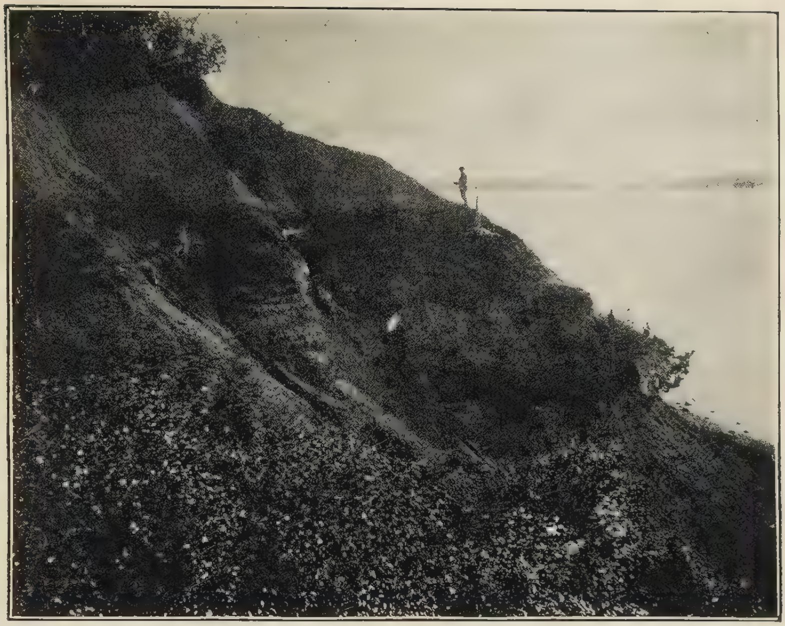

FIG 21.—FOREST BURIED IN CLAY BED IN GRAVELS, NEAR SOUTH END OF RUSSELL FIORD. THE HEAD OF THE BAY IN THE DISTANCE, WITH STRAWBERRY ISLAND ON THE RIGHT. THE MAN STANDS NEAR ONE OF THE BURIED TREES. VIEW LOOKS SOUTHWARD.

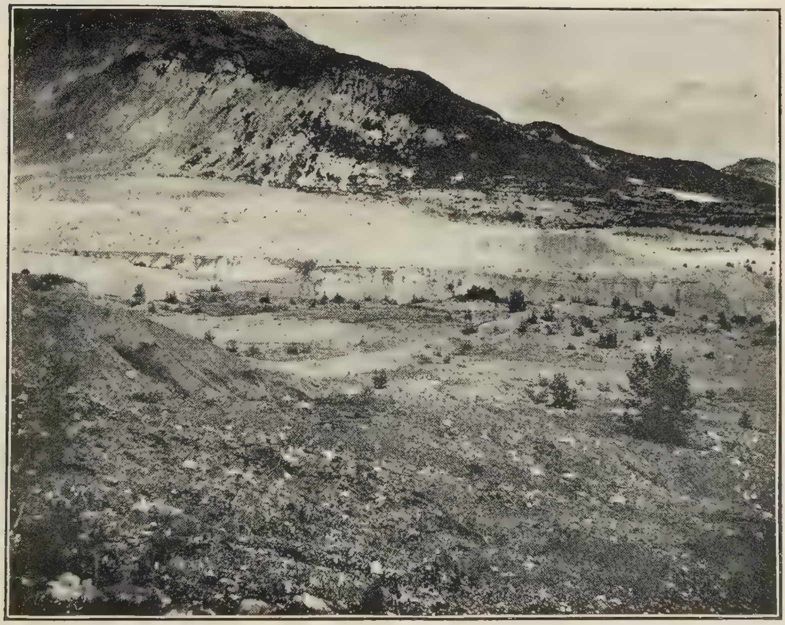

FIG. 22.—LOOKING NORTHWARD ALONG WEST SIDE OF SOUTH ARM OF RUSSELL FIORD, JUST SOUTH OF CAPE ENCHANTMENT. OVERRIDDEN, MORAINE-VENEERED GRAVELS FORM THE FOREGROUND AND THE RIGHT MARGIN OF THE PICTURE. THE GRAVELS ARE REVEALED IN A STREAM CUT IN THE MIDGROUND, AND BACK OF IT IS MORAINE-VENEERED ICE (LIGHT-COLORED), RESTING ON THE GRAVELS. VEGETATION HAS ONLY BEGUN TO REOCCUPY THIS OVERRIDDEN AREA.

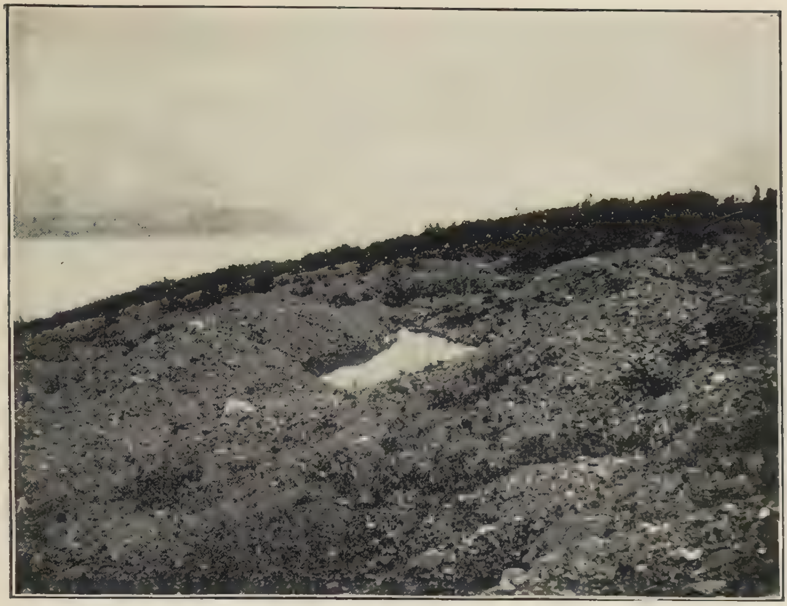

FIG. 23.—SMALL ESKER ON THE RIGHT AND EXTENDING UP TO THE MAN AND THENCE SWINGING TO THE LEFT; RESTING ON THE OVERRIDDEN GRAVELS (FIG. 19) ON NORTH SIDE OF NUNATAK FIORD.

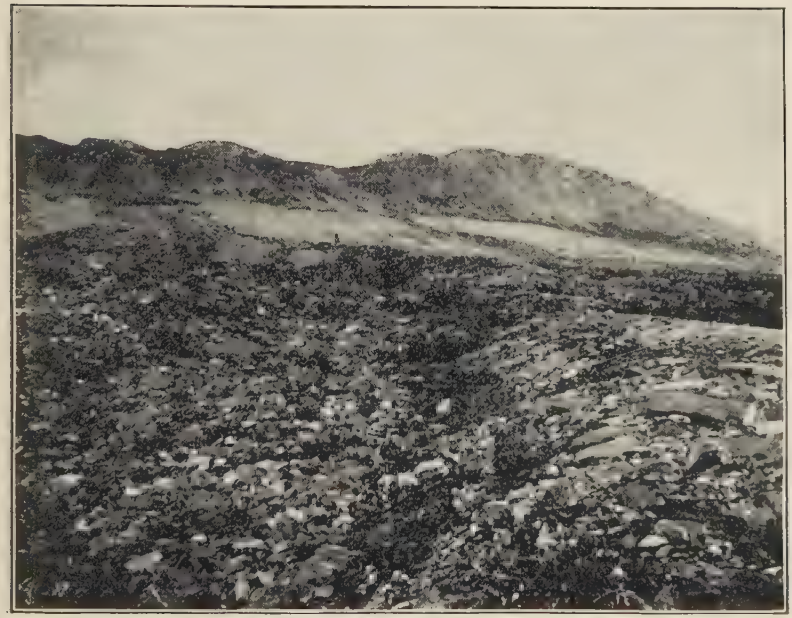

FIG. 24.—LOOKING SOUTHWARD UP THE SOUTH ARM OF RUSSELL FIORD ON THE WEST SIDE. THE OVERRIDDEN GRAVELS NEAR RUSSELL COVE SHOW ON THE LEFT. THE FOREGROUND SHOWS MORAINE OF RECENT ICE ADVANCE. AN ALDER THICKET HAS ADVANCED THUS FAR NORTHWARD, OCCUPYING THE AREA FROM WHICH ICE HAS RETREATED. SOUTH OF THIS THE ALDER GROWTH BECOMES MORE EXTENSIVE, THE REGION HAVING BEEN LONGER FREED FROM ICE.

that the fauna, as well as the flora, has not yet advanced to occupy the regions recently ice-covered. It would be most interesting if this statement could be extended to include the marine life as well, which would doubtless show similar conditions.

One fact of general interest is that the deer, abundant farther south—around Sitka, for example—have not passed the ice barriers and migrated to the Yakutat Foreland, where conditions for their existence are most favourable. The mountain sheep, black and brown bear, wolf, fox, marmot, and some smaller mammals do, however, occupy the region.

Within the area of the Yakutat Bay region itself there is proof of the effectiveness of the ice barrier to the progress of mammals. Puget Peninsula abounds in foxes, and wolves; and both here and on the mainland to the east and west, black and brown bear are abundant. None of these animals were seen in the region between the Nunatak and Hubbard Glaciers; nor were their tracks, very abundant elsewhere, seen there. In harmony with this scarcity, and apparent complete absence, of these mammals from that particular area are two facts pointing to the conclusion that they have not occupied this section. In the first place ptarmigan, which are an easy prey to carnivorous animals, are exceedingly abundant there; in fact we called this the Ptarmigan Coast, and to it sent our natives whenever we wanted a supply of these birds. In the second place, the gulls nest on the ground on the moraine of the Variegated Glacier, while elsewhere in the inlet they build nests on the cliffs in places as nearly inaccessible to foxes as possible.

The extensive ice area of the Nunatak and Hubbard Glaciers, which are badly crevassed, the lofty intervening snow-capped mountains, and the water barrier of the fiord seem to have acted as effectual barriers to the spread of carnivorous mammals to this shore of Russell Fiord. But even these barriers, as at present existing, could hardly have been completely effective for a long time; and the evidence from other directions proves that the ice barrier is now of far less importance than formerly, and that, with its partial removal by recession of the glaciers, the area of unoccupied land has been recently greatly increased.*

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* As at first written this article was prefaced by a general description of the region and a review of the literature; but it became necessary to omit this portion. This is the explanation of the failure to refer more specifically to Russell's splendid pioneer work and to his papers—Nat. Geog. Mag., Vol. III, 1891, pp. 53–203; 13th Ann. Rept. U. S. Geol. Survey, 1891–2, Part II, pp. 1–91—to which we are greatly indebted. Reference should also be made to Frederick Funston's paper—Contributions from the U. S. National Herbarium, Vol. III, No. 6, 1895, U. S. Dept. Agriculture.

THE BUFFALO RIVER: AN INTERESTING MEANDERING STREAM.

BY

ROBERT F. GRIGGS.

The Buffalo River is a swift trout brook rising in Buffalo Lake about twelve miles north of Detroit, Minnesota, and flowing southwest to Muskoda on the shore-line of the ancient Lake Agassiz, where it turns in a northwesterly direction across the old lake bottom till it joins the Red River of the North near Georgetown.

By the direction of its flow, its velocity, and the behaviour of the river itself, it is divided into halves, quite distinct from each other. The upper portion flows off from the "Height of Land" down to the level "Red River Valley," and has a steep gradient, amounting, in the twelve miles between Hawley and Stockwood, to 200 feet, while the lower slope is only about one fourth as steep. Consequently, the upper portion is much swifter than the lower, and babbles along over the rocks in its bottom with a noise which can be heard for a quarter of a mile. The upper river cuts banks of sandy drift from which clay is almost absent. Its course is full of sandbars and obstructed by many boulders, but its water is usually clear and sparkling. Contrasting with this is the sticky gumbo clay of the Red River Valley through which the lower reaches flow. This is only with difficulty taken up by running water, and is then in a finely-divided state, giving the water the turbid appearance characteristic of the streams of the region. This gumbo, once in suspension, settles out but very slowly, so that there are no deposits in bars and the like along its bed, but its channel is swept deep and clean like a canal.

The upper portion furnishes the most remarkable example of a meandering stream the writer has ever been fortunate enough to observe. The swift water working on the soft gravel has a cutting power (or, better, *carrying power,* for there is no cutting to be done) which is almost unbelievable. Everywhere the channel is shifting with extraordinary rapidity as the stream meanders about on its flood-plain. The plate shows a set of meanders near Muskoda which show very well the general character of the upper portion of the river. To the left is a meander in process of being cut off, while in the centre are shown remnants of three former meanders long since cut off and now nearly filled up. A set more striking in its contortions and in the number of cut-offs in process of formation, but sufficiently obscured by brush to render photography impracticable, is shown in Fig. 1, which was sketched from a high hill overlooking the stream about five miles farther up-stream than the plate.

To this habit of rapidly meandering from side to side in its flood-plain the lower river offers a strong contrast. Like all streams of the Red River Valley, it is extremely crooked; but its crooks are relatively stationary, not rapidly shifting. Though bends often approach quite close to each other, cut-offs are of rare occurrence. Frequently the river is actively cutting on both sides of its bed, and deposition, such as is a necessary part of meandering in filling up the cut-offs, is entirely insignificant. There is no flood-plain, but the crooks are deeply sunken into the plain over which the river flows. They belong, therefore, to the class of entrenched meanders.

It seems desirable at this point to call attention to some looseness in the application of the

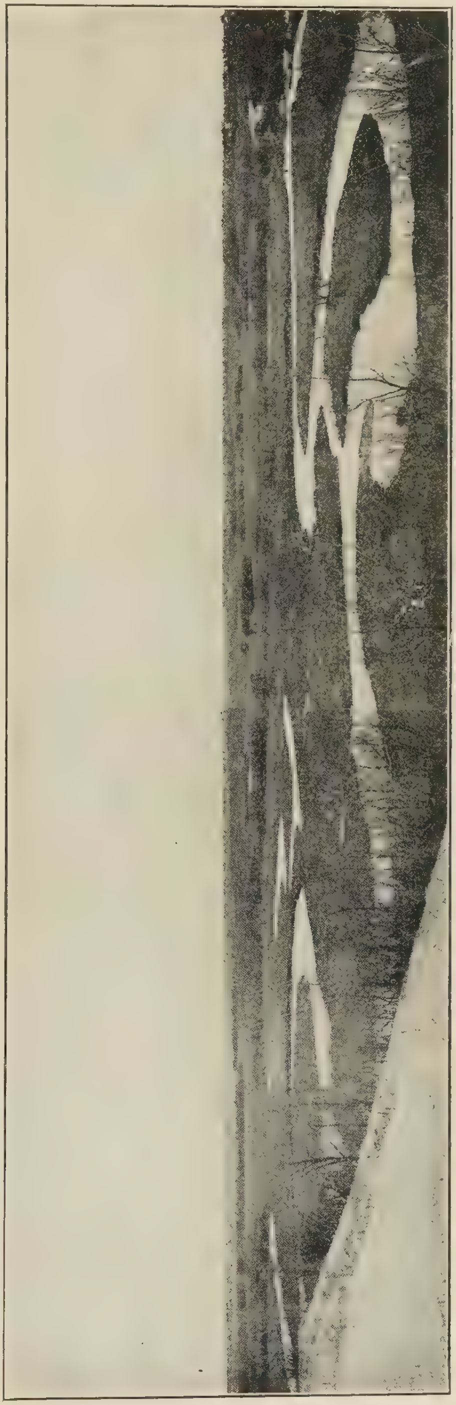

PLATE 1.—MEANDERS IN BUFFALO RIVER AT MUSKODA, MINNESOTA.

term *meandering*. Frequently by a meandering stream is meant simply an unusually crooked one, but if we recognize meander as the *process* which is described in the text-books under that name, we must limit the term to streams in which the process is going on. In other words, a meandering stream is not simply a stream which happens for any reason to be crooked, but one which is *actively* meandering—*i. e.*, alternately cutting and building out its banks so as to become progressively more and more crooked till it finally breaks across the bends and straightens itself for the time being.

In being at the same time a swift stream and one meandering rapidly the Buffalo is an exception not only to the ordinary phenomena of stream action, but also to the statements of the laws which have hitherto been enunciated as controlling the formation of meanders. For it is commonly believed and frequently asserted that meandering is possible only in sluggish streams. Russell* says, "Swift streams are not so easily turned aside as those which flow less impetuously. Hence the former maintain straighter courses than the latter." In the most recent work upon the subject—Chamberlin and Salisbury's Geology†—the same law is stated as follows: "A stream with an alluvial plain is likely to meander widely. In general terms this may be said to be the result of low velocity, which allows it to be easily turned aside." And a few sentences further on: "Even small creeks at high altitudes may meander if so situated as to have slight velocity. Trout Creek in Yellowstone Park is an example." The fact that such has been the statement of the law, and that it has met with wide acceptance, is sufficient evidence that it holds good in the great majority of cases. But, compared with other rivers, the Buffalo can hardly be said to have a low velocity, so that its crookedness must be accounted for in some other way. Since the laws of nature do not admit of exceptions, the statement of the

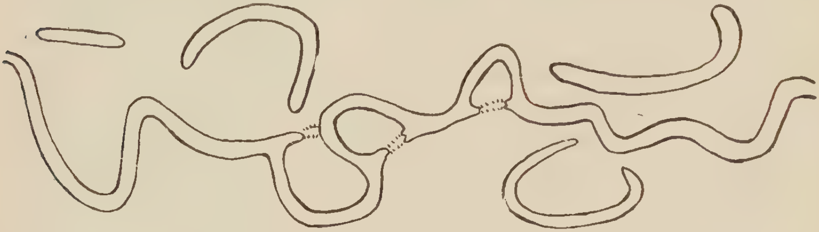
FIGURE 1.

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* Rivers of North America, p. 35, 1898. It should be noted in this connection that Mr. Russell's terms are not absolute but relative, and it is not impossible that his idea of a swift stream and the writer's differ widely.

† Vol. 1: 180-182. 1904.

law of meandering must evidently be at fault and require revision in order that it may cover both the ordinary slow meandering river and such as the Buffalo.

Let us look at the law *à priori* and examine it somewhat. Meanders are usually explained as follows: A stream is never exactly straight, and, if it were, some irregularity in the weathering of the banks or the side swing given by the entrance of a tributary would soon disturb its course and make it vary a little from a straight line. But at the same time the momentum of running water is very great, so that it resists vigorously any obstruction tending to deflect its course; and if forced to turn a corner, loses a considerable part of its power, which, of course, is expended in friction against the obstruction—in the case of a river, the outside bank of the bend. Thus it is that the outsides of the bends are cut away, and, as time goes on, the bend grows more and more crooked. This effect is further increased by the rebound of the current, which throws the water against the opposite bank, which in turn is cut away, so that all the little irregularities in the course of the stream tend to be accentuated and increase. Thus we see—paradoxically, indeed—that the very fact that water tends to flow in a straight line leads to its working out for itself a crooked channel. It is not easy to see how this general reaction of water could be affected by the velocity of the current, and it would seem difficult to fix a limiting velocity beyond which the tendency to meander would vanish in the case of a stream of a given size. On the contrary, it would appear from *à priori* grounds that the higher the velocity, the greater the force working on the outsides of the bends, and, consequently, the greater the rapidity in the formation of meanders. Thus we seem to be led to a conclusion exactly the reverse of that stated by the authorities cited—namely, that in the lateral wandering of a stream, as in most other lines of activity, other things being equal, the power is a function of the velocity, and that with every increase in the velocity comes a corresponding increase in the effect of the force acting.

That this conclusion has some justification in fact may be seen from the Buffalo River; for it is in the swift upper portion that the forces which cause meandering are most active and meanders best developed. In the lower portion, though the velocity is lower, lateral wandering goes on only very slowly, even where the stream is not sunk below the level of the country. This eliminates low velocity from consideration as one of the causes of meandering; for were it a conditioning factor in the process, we should certainly see some relation between the speed—or, rather, the sluggishness—of the stream and its meandering. This is nowhere evident; and we shall have to pass on to the consideration of other possible causes.

But even though this is true, it is beyond question that the authorities quoted are correct in their statement of facts as far as most streams are concerned. Most commonly it is only sluggish streams that meander. If, then, there be no reason theoretically to prevent them, why is it so seldom that swift streams meander? A clue to this question may perhaps be obtained by a comparison of some other features of the streams in question. If we compare the valley of the Buffalo with those generally occupied by meandering streams on the one hand and with those of ordinary swift streams on the other we shall see some points of similarity and of difference which may be very instructive.

Most swift streams are young and flow in narrow cañons, while meandering streams occupy open valleys with broad flood-plains. The cañon is usually cut in hard rock very resistent to erosion as compared with the soft alluvium of the flood-plain. This difference suggests that the tendency to meander may be overcome by the hardness of the banks. But a meandering river is frequently seen slowly widening its flood-plain by cutting away the rocky bluffs at the sides, so that we must at once admit that a stream can cut in a lateral direction even into hard rock. Still, it is evident that in a cañon such cutting is neutralised by the much more rapid downward cutting, while in the broad alluvial valley downward cutting is almost at a standstill. Where a stream is rapidly digging downward and is entrenched in a cañon, it must remove a relatively enormous amount of material for every foot of side swing as compared with a river on a flood-plain. This makes lateral cutting very slow. Further, if it works downward very rapidly, it cannot develop any flood-plain, and so is prevented from suddenly shifting its course—an essential characteristic of meandering streams. This would suggest that meandering is in some way dependent upon the ratio of the downward to the lateral cutting power of a stream, and that it is because the downward cutting in most swift streams is very rapid as compared with the sidewise that meandering is rendered impossible. Upon what, then, does this ratio depend?

Perhaps one of the most conspicuous differences between a river in a cañon rapidly cutting downward and one meandering on a flood-plain is the relative load carried. The ratio of suspended matter to the power of transportation is much smaller in the swift stream, even though the absolute mass be much greater, because of the well-known law that the transporting power of running water increases as the sixth power of the velocity. The scarcity of sandbars and alluvial deposits in cañons, even though the velocity is subject to enormous variations, while with every slight check the meandering river builds up a bar, is a sufficient demonstration of this fact. This difference arises partly because the transporting power of a swift stream is so enormous that it is well nigh impossible in the course of nature for it to receive enough waste to keep it busy, and *partly* because of the differences commonly present in the beds of the two classes of streams, swift torrents working over hard resistent rock, and sluggish rivers washing soft alluvium which crumbles as soon as wet. The work of a stream, whether it consists of moving solid particles of débris along its course or in wearing away the bottom of its bed and cutting downward, requires the expenditure of energy. Now, all the energy of a river is derived from the force of gravity acting on the water flowing down an inclined plane. This energy has a perfectly definite value for any slope, and can be used only once. It would, therefore, seem apparent that if a stream used up all its energy for the transportation of material supplied to it, it has no force left with which to abrade its bed. Consequently, a stream's power of deepening its channel depends on the ratio of load carried to its transporting power.*

While the load remains relatively small, channel-deepening goes on actively; but as soon as the stream becomes overloaded from any cause, it immediately stops cutting its bottom and begins to build it up, as, for example, in an alluvial fan, of which the various types of filled valleys are modifications, due to local conditions. When overloading is carried to an extreme possible only with a granular load like sand, which is not readily compacted and, after deposition, is full of interstices to hold the water, almost the entire force of the current may be expended in the effort to keep its load moving, and the river may almost disappear from view, seeping slowly through its shifting sands. A well-known example is the Platte River, whose channel is so choked with sand that it is barely able to maintain its flow at all. As meandering is impossible where downward cutting is very rapid, so also is it impossible in an overloaded stream like the Platte, since it has no energy left with which to attack even the softest bank. It would seem, then, that meandering belongs to a middle stage, where the load is so adjusted that the river is alternately cutting and filling up its valley.

In a process with so many complicating factors as river action, one is naturally rather hesitant about accepting *à priori* arguments unsubstantiated by other data. It was, therefore, highly desirable to submit this conclusion to experiment and to test its validity. Fortunately, as is well known, the dynamics of river action may be observed in any wayside streamlet after a rain. Accordingly, an effort was made to bring such a streamlet under experiment where the conditions could be controlled. The stream selected was one flowing down a steep grade, so that the current was quite swift. Before it was disturbed it was nearly straight, as such streams usually are. To expedite the experiment, it was turned from its course and made to follow a set of meanders constructed for it. In these prepared meanders each was approximately a semi-circle, and all were of about the same radius, so that the stream, except for accidental variation, due to differences in the number of larger pebbles in its bed, had nearly uniform conditions throughout the portion under experiment. To keep accurate record of the initial position, small sticks were driven into the banks in pairs, one on each side of the current. From a point near the middle of the set of meanders, sand was dumped into the current as fast as it could carry it away, so that one half of the course was heavily loaded, the other lightly. The amount of sand supplied was so great that it could be carried but a few inches before it was dropped, forming miniature sand-bars. These were built out from the lower side of each meander, so as to move the projecting point of the convex bank down stream. This narrowed the channel and forced the water against the opposite bank, which began to crumble and wear away. After about fifteen minutes of this treatment the meanders were appreciably more crooked. In some cases the change was so considerable that all of the swift portion of the current had moved over outside that of the peg originally set at its convex edge, which now stood, therefore, at the concave edge. But in the upper half of the course laid out no change was apparent in the same time. To check the result further the upper half of the course was then overloaded as had been the lower. The response was immediate and identical to that of the lower half. This would seem to show beyond a doubt that a swift stream can be made to meander simply by giving it a heavy load to carry.

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* It must be remembered, of course, that a stream uses the matter carried as the tool with which the deepening is done and with no waste at all a stream would be all but powerless to abrade its bed.

But a stream can never build up a bar above its own level, or even quite up to that level, so that in the experiment, though the whole current was deflected against the farther bank as described, there was always a slight amount of water covering the top of the bar. In the streamlets experimented with, which were of nearly constant volume, a point was reached if the experiment was carried far enough, where the retardation of the current, by its increasingly crooked course and the slight difference in level between the upper and lower sides of the bar built out, gave sufficient head to the shallow water moving across it to enable it to pick up the recently-deposited sand and cut a new channel through it before the meander had been worked out to nearly so great a departure from the original course as is usual in a large river. The cause of the difference is easy to see. In the river the bars are built up above the normal level at every slight rise, thus cutting off the flow across the meander before there is danger of the head across it equalling the force which deflects the water into the longer course. Thus we see that, for the maintenance of a meandering course, variations in the level of a stream are of considerable importance. It is a matter of common experience that meandering streams are usually subject to variations in volume from time to time. The growth of plants is very important in this connection; for in the river the bars are almost at once occupied by plants which by their roots compact and bind together the loose material and by their tops catch more at the next rise, so at once helping to hold the material already deposited and to catch more.

Besides these experiments observations were made upon streamlets lightly loaded with detritus. In such streams, though the force of the current was probably strongest on the outside banks of the bends as assumed in the common explanation of meanders given above, there was still some force left to abrade the inside bank, causing a wearing away of the projecting point on the inside, which, if continued, soon furnishes the stream with a shorter course at a higher grade. This new channel diverts more and more of the current, so that in a little while the stream has abandoned its meander and is following the straighter course. Thus a stream is enabled to straighten its course if it be not so heavily loaded that it must deposit débris with small checks to the current. And we begin to see how it is that swift streams, being usually lightly laden, are "less easily turned aside and maintain straighter courses" than those which, by reason of their smaller velocities and soft valley bottoms, are apt to be heavily loaded. As noted above, the Buffalo, in portions of its lower course, is cutting both of its banks; and while the cut on the inside bank seems not to be sufficient in this case to result in straightening the stream, it certainly must retard its lateral wandering and tend to keep it in its bed.

Deposition on the slackwater sides of obstructions in the current of a river assumes, then, a very considerable importance. Its function is threefold: (1) As shown above, it is a controlling factor in the downward-cutting power of a stream; (2) by building out bars behind obstructions it prevents the stream from removing the obstructions and straightening its course; (3) these bars narrow the channel and force the water yet more strongly against the opposite concave bank, causing it to be worn away more rapidly.

Returning to the Buffalo River, we are in a better position to understand the anomaly it presents of a swift stream rapidly meandering. As described above, its banks are composed exclusively of sand and gravel, so loosely compacted that they offer even less resistance to the wearing of the water than the alluvium of most flood-plains, and as soon as it is touched by a current of the requisite velocity it is whirled away. The stream is thus enabled to pick up on the outside of every bend almost as much as it can carry. A part of this load it is compelled to drop only a few rods below in the slackwater at the next convex bank. The nature of the material is especially favourable to sudden deposition; for the sand and pebbles which make its bank are so coarse that they settle rapidly, affording strong contrast in this respect to fine silt, which requires some minutes to settle even in perfectly still water. The importance of this is manifest, if it be remembered that the slackwater spaces of a small stream are very short, so that such fine silt, even though it might have time to settle in the mile-long slacks of a great Mississippi, would in the Buffalo, before it had reached the bottom, have moved into another riffle, and so its final deposition would be rendered very uncertain. Thus we understand how our stream goes on continually eating out its meanders and building up its flood-plain at a rate incredible to a student familiar only with such sluggish meandering rivers as the Mississippi.

Summarising our results, we may state—partially, at least—the factors controlling the meandering of streams. Meandering is independent of velocity. It is possible only when the stream is so heavily loaded with waste that it begins to precipitate its load with comparatively slight checks to its velocity. A stream, to meander, must be subject to variations in volume. The direct causes of meandering are two: First, the tendency of a loaded stream to deposit sediment behind any obstacle projecting into the current. Such deposits have a double effect: They protect the obstruction from wear and prevent the stream from gradually removing it and straightening its course; and they aid the obstruction in deflecting the current against the opposite bank. The second cause of meandering is the lateral cutting of a current of water, flowing in a crooked channel, on the outside of the bends which confine its course. This is brought about by the centrifugal force of the moving water. These two causes are complementary; each aiding the other, and together giving rise to the remarkable shifting in the channels of such streams as the Buffalo River.

THE BRITISH NATIONAL ANTARCTIC EXPEDITION.

BY

PROF. ANGELO HEILPRIN.

The narrative of the British National Antarctic Expedition of 1901–4, which has latterly been given to the world in two sumptuous volumes entitled "The Voyage of the Discovery,"* establishes for that expedition a just claim to being considered one of the most successful of all Polar ventures. No earlier voyage of discovery into the icy seas, whether in the north or in the south, has more distinctively accomplished its mission than this one; and none has treated more attractively and satisfyingly of the deeds of its explorers, or given in more graphic form the picture of a long-protracted struggle with nature and of the courage and self-denial which sustained this struggle.

Captain Robert Falcon Scott, R. N., the commander of the expedition, has easily earned the distinctions which have been conferred upon him, for he has not only established a far-reaching Antarctic record in his penetration (on Dec. 30, 1902) to lat. 82° 17' S.—an advance of nearly 250 miles on his predecessors—but in minor explorations he did much that, wholly apart from the major explorations, would have given a more than reputable standing to the ordinary aspirant for fame. Of such explorations may be cited the survey of the great Ross Barrier to the point of its disappearance in the easterly King Edward VII. Land and the traverse of the lofty snow and ice plateau which, in South Victoria, extends westward from the Admiralty and Prince Albert Mountains, and rises in its bleak and desolate form, the counterpart of the great ice-cap of Greenland, to elevations of 8,000–9,000 feet or more.

Naturally, the chief interest in the narrative centres about the long southern journey and the traverse of the great Antarctic Barrier which bounds the Ross Sea on the south in about lat. 78° S., and so effectually barred the progress of James Clark Ross sixty years earlier. This vast mass of ice, which extends in an east and west direction for the better part of 350 miles, and which has been assumed by most geologists to represent the terminal or lateral margin of a vast continental glacier, rising in the interior to heights conjectured by some to be 25,000–30,000 feet, is now determined to be an almost perfectly flat expanse of shore-ice or frozen sea-surface—so flat as to make no perceptible rise for the full distance over which it was observed. It was over this ice, following closely the meridional trend of the lofty and clearly-defined mountain ranges of an unmistakable united land-surface (Victoria Land or South Victoria), that the long journey southward was effected. Captain Scott, with much to support his view, believes this flat ice-sheet—which is thought to rest freely on the ocean, and whose front edge (disclosing fairly deep water) has retreated upwards of twenty miles since its existence was made known by Ross—to represent the true contact of the (continental) land and oceanic areas, and with some plausibility argues that this contact-line may extend completely across the polar regions and be followed almost meridionally to Graham Land, to the far south of the extremity of the South American continent. The position and continuousness of the vast mountain ranges, with numerous summits rising above 8,000–10,000 feet, and with a few (Markham, in lat. 83°; Lister, etc.), attaining 13,000–15,000 feet, and extending unbroken to the farthest point of vision (as observed from lat. 82° 17′), would certainly seem to sustain this view, even if the conditions cannot be held to prove it absolutely.

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* Charles Scribner's Sons, 1905.

The "farthest south" of the British expedition, despite the seemingly favourable conditions for its accomplishment that were to be found in the low-lying terrain and a genial and not too high temperature, was attained only after extreme toil and hardship, and through a process which taxed to the utmost the resource and indomitable energy of the commander. No finer exhibition of morale is to be found in the annals of exploration than is disclosed in the narrative of this struggle for the attainment of the unknown, but the cool student of exploration will recognize that just in this struggle is revealed the one weak point of the expedition, and where comparison will fail to sustain for it equality with similar work accomplished elsewhere. The incapacitation of the dog-teams almost with the day of the starting, the breaking in of incipient scurvy, and the reduction of the leader of the party to that degree of mental and physical strain which in the later stages of the journey precluded all interest in the enterprise beyond what touched the cares of the day and the hopes for the morrow, were not the lesson that should have been learned from Mr. Peary's brilliant traverses of the inland ice of Greenland. The geographer cannot but deplore the lack of earnest study in the preparation of the details for this phase of the British exploration, for it cannot be doubted that with a sustained dog-team and the proper adjustment of travelling impedimenta a much farther point south would have been attained than that officially recorded and with a much less expenditure of bodily force. The distance travelled on this journey, going and returning, was approximately 750 miles, accomplished in 93 days, or within almost precisely the same period of time in which Mr. Peary accomplished his memorable "white journey," over an incomparably longer course (although comprised within almost exactly the same degree of latitude N.), in 1892. Somewhat more expeditious was the journey over the westerly ice-plateau in the latter part of 1903, when a distance of 300 miles from the ship's quarters, in lat. 77° 59′ S., long. 146° 33′ E., was covered in 34 days, and with a return in 25 days.

Captain Scott corrects numerous misconceptions which prevail regarding the conditions existing in the Antarctic tract. Probably the most interesting, and certainly the most surprising, of these is that which pertains to the accessibility of the region. Since the early explorations of Wilkes and Ross almost to the present day it has been generally assumed that Antarctica was so closely bound in with ice as to render penetration to it a matter of extreme hazard, and expeditions in search of the unknown in that quarter have been looked upon as hardly more than ventures. Even the more or less successful voyages in recent years of Larsen, Borchgrevink, Gerlache, Drygalski, and Nordenskjöld have not prepared us for the statement (although the counterpart of the condition had already been known to exist in Melville Bay, off the N.W. of Greenland) that during any average February "a ship, by coming directly south on the 178th meridian, could reach the Great Barrier without encountering any pack-ice." And further (Vol. II, p. 407): "It is strange to think that there may be a season in the year when the enterprising tourist steamer may show its passengers the lofty smoke-capped form of Mount Erebus as easily as it now does the fine scenery of Spitzbergen."

Geographers will learn with interest that their notions regarding the size of the Antarctic bergs are not wholly accurate. Apparently there are few bergs which exceed a mile and a quarter or a mile and a half in length, or that exceed 200–250 feet in height—a measure which brings them close within the dimensions of the larger tabular bergs of Melville Bay and the North Water off Greenland. In the region explored by the officers of the *Dis-*

covery there would seem to be no individually-differentiated glaciers of the size of the largest of northwest Greenland. A period of recession has been existing for some time, and the morainic material that hangs to the upper mountain slopes shows in some instances a diminution in the thickness of the glacial ice, as compared with a former period, of 2,000–3,000 feet or more. Captain Scott finds no facts to support the conclusion that the recession of the ice-sheets is due to progressive moderation of the climate, or to the incoming of a warm period. The evidence seems clearly to prove that the present period is an extremely cold one—too cold to permit of sufficient precipitation to form glaciers of the larger dimensions which characterized the earlier periods of higher temperature. Numerous facts to support the conclusion that certain glacial periods might be the result of elevated rather than of depressed temperatures might easily be drawn from other regions of the earth's surface, and perhaps most appealingly from Grant and Grinnell Lands in Arctica, where much of the mountain tracts rising to or above 3,000–4,000 feet (Arthur and Garfield Ranges) is, even on the 82nd parallel of latitude, destitute of a snow-covering.

On the home journey, in the spring of 1904, the *Discovery* sailed westward S. W. of the Balleny Islands, on a course that traversed what on some maps appears as the most easterly part of Wilkes Land. No land was here sighted, not even at the point, in long. 154° E., where Cape Hudson should have appeared as a conspicuous landmark. This negative determination can, however, hardly affect the question of the more broadly-determined facts which pertain to the assumed land-masses lying farther westward which were described and pictured by Wilkes. It is earnestly to be wished that some country desirous to add to the fame of its flag, or a generous patron of discovery, may before long despatch an expedition equipped for service along the line that was traversed by Wilkes and for the survey of that still largely unknown area which is comprised between the meridians of 90° and 150° of east longitude.

No very important light is thrown upon the geological construction of the Antarctic regions through the researches of the British National Antarctic Expedition, despite much attention that was paid to geological details. The heavy covering of snow and ice precludes extensive study or examination of rock-masses, and, unfortunately, in the region under examination no determinable fossils were obtained. In this relation, therefore, the region seemingly offers much less than Graham Land and the adjacent island (Seymour Island) and islets, where Larsen and Nordenskjöld obtained the remains of araucarian forests, besides a fair abundance of Jurassic, Cretaceous, and Tertiary (?) molluscan forms—all helping to establish a biologic connection, whether on the land or in the sea, between the faunas of the far south and those of the region lying north of Lat. 55° S.

Space does not permit of more than a reference to the special scientific work of the expedition, which will doubtless be detailed in future monographs by those most competent to treat of the different subjects. Of particular interest among the geological studies are those pertaining to the life histories of the different species of seal and of the emperor penguin. One cannot properly pass over this section of the work without referring to the extraordinary habit which is recorded of one or more species of seal of dragging their bodies, at about the time of impending death, to distances on the inland ice of fifty miles or more and to elevations of 5,000 feet. The geologist and physical geographer can well appreciate at this time what destructive evidence bearing upon land elevations or oceanic transgressions might be obtained from the remains of these sea-animals that are now found so far removed from their natural habitats. In its present climatic aspects Victoria Land may not improperly be compared with the far north of Greenland or with the opposite Ellesmere, Grinnell, and Grant Lands. A mild and genial summer temperature—less mild, however, than in the Arctic tracts—alternates with a winter of extreme severity, and contrasts with the monotonous cold that in more or less continuousness was noted by Nordenskjöld in the region of Graham Land. The lowest official recorded temperature made during the traverse of the lofty plateau was − 72°.

The illustrations which accompany Captain Scott's work do full justice to the text, and in themselves would give exceptional value to the report. Few works of travel and discovery have had such support given to them from the camera and photographic process.

GEOGRAPHICAL RECORD.

AFRICA.

THE NILE-RED SEA RAILROAD.—The new railroad across the Nubian Desert, between the Nile and the Red Sea, was opened for business February 17. The line is 331 miles long, and it has cost about $8,000,000. Construction began at the Red Sea in August, 1903, and the first train passed over the road in October, 1905, the entire work, therefore, occupying only a little over two years. The Red Sea terminus is Port Sudan, 30 miles north of Suakin, to which as a harbour it is much superior.

During the past year many houses have been erected for the whites, the railroad station and lighthouse have been built, and 4,000 labourers have been making port improvements; and the working force will be increased to 6,000 this summer.

The Nile terminus of the road is at the mouth of the Atbara River, a short distance south of Berber, where trains will be switched to the Wadi Halfa-Khartum railroad for their destination—Khartum or Berber. As the country traversed is almost completely desert, it can supply little or no commerce, and the purpose of the road is to cheapen freights between the Anglo-Egyptian Sudan and the outside world by supplying a short route to the sea.

SURVEY OF THE MOROCCAN COAST.—Some time ago the French Committee of Morocco appealed to the public to contribute to the work of pacific penetration in Morocco which Mr. Delcassé had undertaken. Mme. Hériot thereupon offered a substantial sum of money for the much-needed survey of the Atlantic coast of Morocco. The only naval chart of that shore now in use dates from 1835, and is full of errors. Lieut. Dyé and Mr. Renaud were selected to study the outlines of the coast from Tangier to Agadir. The work was carried out last year, and Lieut. Dyé's report is printed in the *Bulletin* of the Comité de l'Afrique Française. This coast in winter has long been the terror of navigators, and the conclusions which the surveyors have reached do not lessen its bad reputation. The report explodes the idea that there is a good natural port at Agadir in the Sus region. There is, in fact, no natural port in Morocco on the Atlantic coast. Many valuable suggestions as to navigation in those waters—the construction of lighthouses, etc.—are given.

METEOROLOGY AT THE BRITISH ASSOCIATION IN SOUTH AFRICA, 1905.—In the October and November numbers of *Symons's Meteorological Magazine*, Dr. H. R. Mill gives an account of the meteorological and climatological matters of interest in connection with the South African meeting of the British Association. On the voyage to the Cape a lecture was given by Professor W. M. Davis "in 1° N., on August 7th," on the Weather of the Atlantic, and another, by Dr. Mill, "in 15° S., on August 10th," on the Bed of the Sea and the Circulation of its Waters. At a meeting of the General Committee at Cape Town on August 15 an important resolution was adopted regarding the co-ordination of the meteorological services of the British Empire. The object of each department of the service would be the collection and summarizing of observations taken in different parts of the Empire, and the providing of

> a scientific staff for dealing with the more general meteorological problems, including their relation to Solar Physics and Terrestrial Magnetism, which involve the co-ordination of data from wide areas, and to promote experimental investigations of the scientific questions which arise in connection with such discoveries.

A truly epoch-making resolution!

Several papers of meteorological interest were read, but were scattered through different sections, which interfered with their discussion by those most directly concerned. A Meteorological Breakfast, which has become a feature of the British Association meetings in England of late years, was held at Cape Town on August 18th. At Johannesburg further sectional meetings were held, and more papers were read. The new observatory of the Transvaal Meteorological Service was thrown open by the Director, Mr. R. T. A. Inness, who showed the admirable equipment of self-registering and other instruments. The journey into the interior afforded opportunity for further study of local meteorology and climate. The full effects of the dry season were noted in the bare, dry veld, "covered with burnt-up grass and low shrubs, but only wanting irrigation to become extremely fertile." Fine displays of sheet lightning were seen on the high veld, but there was no thunder or rain. In the intensely dry weather the hair crackled with electricity when being brushed.

At Kimberley the observatory of Mr. J. R. Sutton was visited. This observatory was partly equipped by the De Beers Company, but all the observations are taken by Mr. and Mrs. Sutton. Mr. Sutton's work at Kimberley has already received notice in this BULLETIN. Going north from Kimberley, the grass on the dry veld gradually gave place to low, thorny shrubs and next to thin forest, the green leaves breaking out afresh in advance of the rains. It being the end of the dry season, the water in the Zambesi was at its lowest, and therefore the scenery of the rock gorges at the Victoria Falls could be well seen. At Buluwayo, on September 14th, the shade temperature was 85° and the wet-bulb 55°, showing a relative humidity, according to the tables, of only 9%! As Professor C. V. Boys said in a lecture at Cape Town, in the interior of South Africa water evaporates as rapidly as does alcohol in damper climates. R. DEC. W.

AFRICAN CLIMATOLOGY.—Meteorological observations from portions of Africa but recently redeemed from savagery are accumulating rapidly. Among the publications which deal with African climatology the *Deutsche Ueberseeische Meteorologische Beobachtungen* are of great value. These volumes are issued by the German Naval Observatory (Deutsche Seewarte) at Hamburg, with the co-operation of the Colonial Division of the Foreign Office. Volume XIII, a quarto of 317 pages, is a continuation of Vols. X and XI, and deals with observations from German East Africa. The hourly readings of barographs, thermographs, anemographs, hygrographs, and sunshine recorders are given for stations where these instruments are in operation. There are also complete eye observations of the ordinary elements, made three times daily at 22 stations. Details regarding the location and exposure of the different stations, as well as the corrections for the local readings, are given in each case. The hours of observation differ; in most places they are 7 A.M., 2 P.M, and 9 P.M., but in individual cases they are 8 A.M., 10 A.M., and 4 P.M. (TANGA); 7 A.M., 2 P.M., and 8 P.M. (KWAI); 6 A.M., 1 P.M., and 6 P.M. (NEU-KÖLN), and various (KILOSSA). This is an extremely valuable collection of data when the locality in question and the completeness of the observations are considered. R. DEC. W.

AMERICA.

COAL RESOURCES OF WYOMING.—The School of Mines of the University of Wyoming publishes as *Bulletin* 7 a report on the coal resources of the State by Professor L. W. Trumbull. In 1869, 58,186 tons were mined; while the production in 1905 is estimated at 5,500,000 tons. The various estimates of the area of the Wyoming coal measures at from 20,000 to 40,000 square miles are probably under the truth, though undoubtedly much of the coal is so deeply covered that it will not be dug for many ages. All the coal is found in rocks of the Cretaceous, this formation being to Wyoming what the Carboniferous is to Pennsylvania. The report contains a sketch map showing the wide distribution of the Cretaceous, and also of Cretaceous covered by Tertiary.

THE ILLINOIS STATE GEOLOGICAL SURVEY.—The Illinois State Geological Commission was organized last August by the appointment of Prof. T. C. Chamberlin, of Chicago University, to serve with the *ex-officio* members, Governor C. S. Deneen and President Edmund J. James of the State University. Dr. H. Foster Bain was appointed Director of the State Survey in September, and took up his work in November last. The Board had already arranged for topographic work in the season of 1905, and the results have been announced in the *Bulletin*. The work planned for 1906 includes the completion of the survey of the Wheaton and Aveston quadrangles, which were partly surveyed in 1905, with the survey of the Galena, Waukegan, and Farmington quadrangles. In addition, a line of precise levels is to be carried from Chicago to Odin, one-half the work being done in 1906 and one-half the following season. In a line of precise levels, run last year, 84 miles long, the actual error was found to be less than a quarter of an inch; and in certain primary traverse lines, 60 miles long, run around one of the quadrangles, the circuit came within 20 feet of longitude and ten feet of latitude closing. The work is being done with unusual care, level lines being run along all of the roads, up many of the streams, and well out into the sections between the roads. In 1905, 365 geodetic stations were occupied, and more than 3,500 miles of spirit-levels run. It is believed that the maps, when completed, will be quite as good as any that have yet been made. It is found that in Illinois, owing to the general flatness of the country and the large number of straight roads, it is possible to make accurate surveys with unusual economy.

The geologic work proper is now being organized. In general it will be mainly directed to a study of the coal and clay resources of the State. The work on the latter has already been begun. Mr. Ross C. Purdy, late of the Ohio State University, and now Instructor in Ceramics at the State University of Illinois, under the direction of Professor C. W. Rolfe, is making a complete study of the paving-brick industry and the paving brick clays of the State. This is to be followed by a study of the pottery industry. Mr. Purdy took up field work in November, and material is being collected for a careful series of laboratory investigations running through the winter months.

PINE SEEDS DISTRIBUTED BY PREVAILING WINDS.—In a recent report on the *Loblolly Pine in Eastern Texas* (U. S. Department of Agriculture, Forest Service, Bulletin No. 64, 1905), by Raphael Zon, reference is made to the distribution of the seeds of this pine by the winds. On the wet prairie of Eastern Texas islands of these trees are very characteristic, occurring on slightly-elevated mounds. In the early stages of development these islands are often almost circular, with the older trees in the centre and the younger ones towards the margins. Loblolly pine seeds ripen at the end of September and early in October. At this season dry northwesterly winds prevail. These winds hasten the opening of the cones and carry the seeds towards the southeast. R. DEC. W.

THE NEW JERSEY GEOLOGICAL SURVEY.—This Survey is revising and issuing new editions of its topographical atlas on a scale of one inch to a mile. Last year four new sheets replaced an equal number of older sheets now out of print. It is also preparing and publishing from time to time topographical sheets on a scale of 2,000 feet to an inch. In 1905 three sheets were issued and surveys were completed for three more. There will soon be twenty-four sheets on this scale.

Studies were made of the Upper Passaic Valley in elaboration of the proposed plans for controlling floods upon that river by a dam at Little Falls and for the establishment of a permanent lake and reservoir. Investigations were also made of the wasting of the beaches and the shifting of bars and channels at the inlets and the best methods of controlling these movements.

The peat, sand, limestone, and building stones of New Jersey were the subject last year of special investigation, both in the field and laboratory, and reports are being prepared upon the peat and limestones. The sands and building stones are still under investigation.

Studies are in progress regarding the trap rock and associated copper deposits, with a view of determining the source of the copper and its mode of accumulation.

Paleontological studies have been pursued on the fauna and flora of the Cretaceous formations, and reports are being prepared for publication.

GLACIAL PHENOMENA ALONG THE NORTH SHORE OF LAKES HURON AND MICHIGAN.—The last Annual Report of the Michigan Geological Survey (Report for 1904) contains a paper by Prof. I. C. Russell, in which the glacial phenomena of a part of northern Michigan are described and discussed (pp. 57–94). There is a consideration of the evidences of ice erosion, including a discussion of certain interesting features relating to striæ and the bearing of these on the subject of ice erosion on a large scale in this region. Regarding Lakes Huron and Michigan, Russell is of the opinion that the glaciers did more toward filling pre existing basins than of deepening them. His paper discusses various drift forms and the shore-lines and clays of the ancient ice-dammed lakes. Perhaps the most notable section of the paper is that on drumlins, of which there are two areas in the region covered by his work—one the Les Cheneaux area, the other the Menominee area, in approximately the same latitude, but 125 to 150 miles apart. In addition to a description of the characteristics of the drumlins of these areas, in which they form the dominant topographic forms, Russell discusses their origin, and concludes that the drumlins of the Menominee region have resulted from the erosion of a previously-deposited till sheet. This is a revival of Prof. Shaler's theory, which a majority of glacial geologists have discarded in favour of the theory of formation by sub-glacial deposit. R. S. T.

GLACIAL STUDIES IN THE CANADIAN ROCKIES AND SELKIRKS.—A paper under this title by Dr. W. H. Sherzer (Smithsonian Miscellaneous Collection, Vol. II, Part 4, pp. 453–496) describes in detail the phenomena illustrated by a number of the glaciers of Alberta and British Columbia. The physical features of the ice, the banding of the ice, the moraines, the rate of ice motion, and the frontal changes are all discussed upon the basis of observations upon several glaciers. One of the most noteworthy points brought out by this paper is the clear evidence of a shearing along planes between adjacent ice strata. This paper, which is illustrated by a large number of excellent half-tones, is an important contribution to glacial geology, both from the standpoint of its local details and of its discussion of general principles of ice characteristics and behaviour. R. S. T.

MODELS OF MARTINIQUE AND MT. PELÉ.—The American Museum of Natural History in this city is now exhibiting a series of models illustrating the island of Martinique and the effects of the eruptions of Mont Pelé. There are four models, one of which is the whole island upon a scale of 1:80,000, modelled from the French Admiralty Chart, and three enlarged models of the volcano itself upon a scale of 1:24,000, or 2,000 feet to an inch. In all the models the vertical scale is the same as the horizontal. The first of the large-scale models shows the volcano as it was at the first great eruption on May 8, 1902, when the city of St. Pierre was destroyed. The second shows the changes in the volcano in the succeeding months, including the destruction wrought by the eruption of Aug. 30, 1902; and the third shows the wonderful spine and cone of lava pushed out of the conduit and crater during the winter and spring of 1902–3, the time selected being the period of maximum development.

RAILROADS IN GUATEMALA.—Mr. Charles M. Pepper, in his monograph on "Guatemala" (Washington, 1906), says that the Northern Railroad will be open for traffic by the end of 1906. The line extends from Guatemala City to El Rancho and thence to Puerto Barrios. This will place the capital and the whole interior of the country in direct communication with Puerto Barrios and insure a large reduction in the cost of freight. It will also open up a very rich region which now has only the most primitive means of communication. On the Pacific slope the leading railroad system is the Guatemala Central. Its main line and branches cover the coffee-raising districts of the Pacific Coast. In addition to its railroads, Guatemala has recently built, or is now constructing, a system of nine highways or cart roads extending through various parts of the country.

AUSTRALASIA.

GLACIAL EROSION IN NEW ZEALAND.—Recent literature has furnished descriptions of conditions in Alaska, Norway, Switzerland, and other regions which point strongly to the conclusion that glacial erosion has profoundly modified the valleys of these regions, and given rise to some of their characteristic topographic features. Southwestern New Zealand resembles Norway and Alaska in mountain form, fjorded coast, and former great extension of glaciers; and it is interesting, therefore, to note that the topographic features which have caused the belief in marked erosion in Norway and Alaska are found in great perfection also in New Zealand. A recent paper by E. C. Andrews (Trans. Australasian Assoc. Adv. Sci., Jan., 1904, pp. 189–205) describes and interprets these features and illustrates them with a series of excellent half-tones.

Going to New Zealand from eastern Australia, Mr. Andrews was impressed by the absolute difference in the topography of the two regions, although both were in approximately the same stage of topographic development. In eastern Australia the tributary valleys enter the main streams at grade, and the valleys possess a series of overlapping spurs; but in southwestern New Zealand the tributary valleys join the main valleys at discordant levels, in some cases 2,000 feet above the valley bottom, and the valley wall spurs are truncated—in some cases entirely removed, in others partly destroyed. These two results, and some other features of the region, Andrews assigns to glacial erosion, agreeing with the interpretations of Gannett, Davis, Gilbert, Penck, and others for European and American regions. Andrews' paper is an important contribution to the subject of glacial erosion, adding one more glaciated district which possesses topographic features that so far have not been recognized in perfection in non-glaciated regions. R. S. T.

DROUGHT OF 1901–1902 IN NEW SOUTH WALES.—*The Results of Rain, River, and Evaporation Observations made in New South Wales during 1901–1902*, under the direction of H. C. Russell, Government Astronomer, recently received (date of publication 1904), give some startling facts regarding the drought of these years. Although now somewhat out of date, this volume gives the first authentic information, coming through the official meteorological channels of the New South Wales Government, which has been sent us as to the conditions of this unprecedented drought. Taking the rainfall of 1902 for the whole State, the amount is the smallest on record except that for 1888. The year 1902 had an average of 14.09 inches, while 1888 had 13.40 inches; but 1888 was preceded by a series of years of plentiful rainfall, and 1902 was the eighth consecutive year of drought. The results were most disastrous, especially in the western country. Here sand and dust storms, due to persistent dry winds, were a dominant feature. Drifting sands were carried over the plains until stopped by fences, where they were banked up and formed dunes. Stockyards, wool-sheds, gardens and fences were buried; dams were filled up, and their embankments destroyed.

During the seven years ending with 1901 the number of sheep grazing in the Western Division fell from 16,000,000 to about 5,000,000, the total loss being fixed at at least 30,000,000 pounds sterling. The effect of the drought was shown in a peculiar way—in the decrease in the number of voluntary meteorological observers. There had previously been a steady increase up to 1719 in 1901, but the number fell to 1650 in 1902 as the result of the temporary abandonment of their homesteads by the farmers. Much the same thing, it may be noted, happened in South Africa during the recent drought there. R. DeC. W.

EUROPE.

THE BASIN OF THE MOSELLE.—No. VII of "Ergebnisse der Untersuchung der Hochwasserverhältnisse im Deutschen Rheingebiet" is devoted to the basin of the Moselle, including those parts of it outside the German territory. The Moselle is the most important tributary of the Rhine on the left, and this official report, prepared in the Meteorological and Hydrographical Bureau of Baden, and published by Wilhelm Ernst & Son, Berlin, is practically exhaustive and a fine example of the thoroug discussion of the various physical aspects of a river. The quarto volume is richly equipped with superior maps in colours, among which are sheets showing the topography and geology of the basin, its forestation, and the distribution of its rainfall.

THE FOREST-LINE IN THE AUSTRIAN ALPS.—Professor R. Marek has a preliminary report in the *Mittheilungen* of the Vienna Geographical Society on his studies of the altitude of the forest-line in the Austrian Alps. He finds that this line sinks continuously from west to east, the rate of fall increasing towards the east, and a difference of 556 meters being recorded in an area that extends through about five degrees of longitude. The average height of the forest-line is about 750 meters below that of the snow-line.

BALLOON VOYAGE ACROSS THE ENGLISH CHANNEL.—Messrs. C. F. Pollock and Martin Dale, members of the Aero Club, made a successful balloon voyage from England to France on Feb. 3. They passed out to sea at Eastbourne at 2 P. M., and, after a speedy crossing of the Channel, descended between Havre and Dieppe in three hours twenty minutes after the start. The distance travelled was 140 miles. The balloon was inflated with 50,000 cubic feet of gas.

POLAR.

BARON VON RICHTHOFEN'S LAST WORK.—The house of Dietrich Reimer, Berlin, has just printed, at the special request of Emperor William, the incomplete report of the "Ergebnisse und Ziele der Südpolarforschung," which von Richthofen had begun to prepare for the Emperor shortly before death ended his labours. The famous geographer gives a survey of the problems to be solved by the South Polar expeditions, and describes particularly the services of the German expedition under von Drygalski, a pupil of von Richthofen, in the investigation of the fauna and flora of the regions explored. This is the extent to which von Richthofen had completed the work.

BAFFIN ISLAND NOT TO BE RE-EXPLORED AT PRESENT.—Concerning the recent report that Canada proposed to re-explore Baffin Island and its great inland lakes, Mr. James White, Geographer for the Department of the Interior, writes that the Government does not at present intend to undertake this work. It is, in fact, doubtful that the work will be undertaken in the near future, in view of the enormous extent of the Canadian territory, more accessible and of much greater importance, that still remains to be studied in detail.

THE SCIENTIFIC STATION ON DISCO ISLAND.—We have received a letter from Dr. Morten P. Porsild announcing that the proposed permanent station for the study of Arctic science on Disco Island, in Danish West Greenland, will be established under his direction this summer. The cost of founding the station has been met by Mr. A. Holck of Copenhagen, and the Danish Government has granted the sum of $3,000 annually for its maintenance. The station will be especially equipped for biological researches, and conveniences for work will be supplied for visiting naturalists, both foreign and Danish. Visitors can first be received in 1907, and notices inviting applications wlll be sent out in due time. It is expected to establish at least two out-stations where investigations may be carried on as well as at the central laboratory. Visitors will have free use of the instruments, travelling outfit, and library; lodging will be free, and a small charge will be made only for board. Dr. Porsild will be glad to receive gifts of publications relating to the Arctic regions, and especially to Arctic biology. It is desired to make the library as complete as possible; but as the resources of the station are limited, only a small part of the books can be purchased.

VARIOUS.

A PERIODICAL DEVOTED TO EARTHQUAKES.—The Magazine *Die Erdbebenwarte*, edited by Professor A. Belar and published at Laibach, is now in its fifth year. Among the contents of the latest issue (Vol. V, Nos. 1–4) are articles on the Seismic Observatory in Munich; Earthquakes in Servia in 1904 (125 distinguishable without the seismograph, and many earth tremors); Premonitions of a volcanic eruption by means of a seismograph (the outbreak on Savaii as indicated at the Samoa Observatory, Apia); Vicentini's new seismograph; monthly earthquake reports, book reviews, notes and news, etc. It is a publication of great value to the student of earthquake phenomena.

VESUVIUS IN ERUPTION.—Mount Vesuvius was very active early in February. The lava reached three places on the Vesuvian railroad line, covering about 100 yards of it at each point.

DISTRIBUTION OF EARTHQUAKES.—The relations of the structure of the earth's crusts to earthquakes are discussed in the January number of the *Annales de Géographie.* "Observations of more than 170,000 earthquakes show that they occur almost equally and exclusively along two narrow zones lying on two great circles of the terrestrial sphere; the Mediterranean or Alpine–Caucasian–Himalayan circle, with 53 per cent. of recorded earthquakes, and the circum-Pacific or Andeo–Japanese–Malaysian circle, with 41 per cent." These observations, it is asserted, give no support to the theory that the tetrahedral distortion of the earth's crust is due to this cause.

THE KANGRA EARTHQUAKE.—Thirty-six pages of the *Records* of the Geological Survey of India (Vol. XXXII, Part 4, 1905) are given to a preliminary account of the Kangra earthquake of April 4 last year. The report is written by C. S. Middlemiss, one of the three superintendents of the Geological Survey. The starting-point of the earthquake was the Kangra district of the Northwestern Himalayas. About 20,000 persons are estimated to have perished, the loss of life being greatly increased by the fact that the most violent phases of the shocks occurred early in the morning, when many were still asleep. The earthquake was appreciable to the senses over an area of about 1,625,000 square miles, or a territory more than half as large as the United States. The shocks were brief and of powerful intensity. At Dharmsala it was impossible for a person to keep his feet while standing or walking. It has not been possible to decide as to the depth of the centrum, where the disturbance originated. The rate of movement of the earth-waves appears to have been 1.9 miles per second, or considerably less than the rate in the Charleston earthquake, which was about 17,000 feet per second. The conditions among the mountains were ideal for the production of land-slides on a gigantic scale. Two maps show the outer boundary of the shaken area, the four highest isoseismals and the approximate positions of the axial epicentrums.

THE INTERNATIONAL GEOLOGICAL CONGRESS IN MEXICO.—The General Secretary of this Congress has distributed the programme of the excursions to be held in connection with the meeting of the Congress in the City of Mexico during next September. Four excursions are provided before the opening of the Congress. The first, lasting four days and confined to 250 persons, is to be to the east from Mexico City through Jalapa to Vera Cruz, returning to Mexico through Esperanza; the second, to the south, will be eight days and limited to forty persons, the party going to Esperanza, Tehuacan, and Oaxaca; the third, limited to thirty members, will include visits to the volcanoes of Toluca, San Andres, and Jorullo, and will last fourteen days, nine of which will be on horseback; the fourth is to be to the geyser district of Ixtlan and to the volcano Colima. During the meeting of the Congress short journeys will be made to various places near the capital, and at the close of the sessions an excursion to the north of twenty days and another to the Isthmus of Tehuantepec will take place.

COST OF MOUNTAIN-CLIMBING.—In Switzerland a tariff is established by the Government, which declares what the fee shall be for the climbing of any of the principal peaks. The fee is regulated by the time consumed and the difficulties presented in making a given ascent. The Matterhorn will cost the climber 200 marks ($40); Mont Blanc probably as much; the Eiger and Mönch in the neighbourhood of 125 marks ($25), and so on down to 10 francs, which is the smallest amount charged for any peak. Under the Swiss tariff a mountain such as Rainier would probably cost the climber about $30 for the ascent.—*Mazama*, December, 1905. Page 218.*

A CONTRIBUTION TO KNOWLEDGE OF THE PACIFIC.—The Smithsonian Institution has just printed (*Bulletin* No. 55 of the U. S. National Museum) a compilation of data collected by the U. S. S. *Nero* while engaged in the survey of the route for our trans-Pacific cable in 1899. The number of soundings was 2,074, or an average of one for every 10 miles of distance run. The survey followed lines as direct as practicable from Honolulu to Midway Island, thence to Guam and Luzon, and also from Guam to Japan.

The *Bulletin* contains an abstract of the official record of soundings showing the position, depth, surface and bottom temperatures, character of the bottom, and deposits; also a record of the detailed examination of selected specimens of deposits from stations on the outward voyage of the *Nero*. A belt of ocean about 14 miles wide and over 6,000 miles long was examined, and the parts of the ocean covered by this very thorough survey are shown by a diagram. It was during this work that the deepest sounding ever recorded was found about 75 miles east-southeast of Guam. This sounding is in 12° 43′ 15″ N. Lat. and 145° 49′ E. Long., and is only 66 feet less than 6 statute miles.

COMMERCIAL RESEARCH IN THE TROPICS.—The Liverpool Institute of Commercial Research in the Tropics has sent its first expedition to West Africa. The five members of the party will visit Dakar, Bathurst, Konakri, and, if possible, the Cameroons. As the expedition is experimental, the visit will be a short one; but if the results are satisfactory, a second expedition will probably go out to spend a long period in Africa. The present party will inquire especially into the cultivation of rubber—how to improve the quality of West African rubber, and how to protect and increase the present supply. An effort will also be made to find new sources of oils and means of increasing the supply by utilizing the present waste. Investigations will also be made regarding the establishment of hemp, cotton, jute, and ramie growing, and also of new fibres.

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* It is a small matter, but four marks are equal to a dollar, and the mark is not Swiss.

KOLONIAL-HANDELS-ADRESSBUCH, 1906.—The latest edition of this invaluable work of reference for all who are interested in the German colonies contains statistics and information concerning their present stage of development, including lists of the colonial companies, traders, farmers, missionary posts, colonial governments, communications, and trade. The work includes maps of each of the colonies. It is published by the Kolonial-Wirtschaftliches Komitee, Berlin.

PERSONAL NOTES.—From May last until the end of the year, Dr. G. K. Gilbert was in the Sacramento Valley, California, studying the regimen of the Sacramento and its branches with regard to the transportation of débris. This work is connected with the investigation of hydraulic mining in the Sierra Nevada in its relation to agriculture in the Sacramento Valley.

Dr. C. Kenneth Leith, Professor of Geology in the University of Wisconsin, is working, in collaboration with President C. R. Van Hise, on a monograph of the entire Lake Superior region—a work that will be a co-ordination and summary of two generations of geological exploration and study in a region of remarkable interest. The work will soon be published as a Geological Survey Monograph.

U. S. BOARD ON GEOGRAPHIC NAMES—Decisions March 7, 1906:

ALAMOGORDO: election precinct and town, Guadalupe county, N. Mex. (Not Alamo Gordo.)

BANCROFT: mountain, on the county line between Clear Creek and Grand counties (southern part of S. 29, T. 23, R. 74 W.), Colo. (Not Lomand's, Millar's, nor Perry Peak.)

BATTIE: mountain, Camden town, Knox county, Maine. (Not Beattie nor Beatty.)

BOULDER: creek, Matanuska valley, 40 miles northeast of Knik arm of Cook inlet, Alaska. (Not Schoonhoven nor Schoonoven.)

*BREWSTER: precinct and town, Okanogan county, Washington. (Not Bruster.)

CHICKAWAUKIE: pond, Rockland and Rockport towns, Knox county, Maine. (Not Cichicwaukie nor Chickawaka.)

DEATH VALLEY: valley, Inyo county, California. (Not Amargosa Desert nor Lost Valley.)

ELBOW: lake, 4 miles east of mouth of Thunder Bay river, Alpena county, Michigan. (Not Carp nor Crooked.)

*HANKOW: capital, province of Hupeh, China. (Not Hankau.)

KINGS: mountain on the east bank of Matanuska river, 40 miles northeast of Knik arm of Cook inlet, Alaska. (Not House.)

LILLY: pond, Rockport town, Knox county, Maine. (Not Fresh nor Lily.)

LITTLE NESENKEAG: brook, tributary from the east to Merrimack river, Hillsboro county, N. H. (Not Chase's, Chases, Massenteean, Mossenteean, nor Reed's.)

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* Reversal of former decision.

Monroe: island, southeast of Rockland, Knox county, Maine. (Not Munroe.)

Nesenkeag: brook, tributary from the east to Merrimack river, Hillsboro county, N. H. (Not Brickyard, Chase, nor Great Nesenkeag.)

*Newchwang: treaty port, province of Liaotung, China. (Not New-Chwang, Niu-chuang, Niu-Chwang, Niuchwang, nor Niutschuan.)

Sangerfield River: branch of Chenango river, Chenango, Madison, and Oneida counties, N. Y. (Not Chenango Creek, East Branch Chenango river, nor East Chenango river.)

Shandon: railroad station and village, Butler county, Ohio. (Not Glendower, New London, nor Paddy's Run.)

Soochow: city, China. (Not Soo-Chow-Foo, Soo-Tchoo, Sou-Tcheou-Fou, Su-chau, Su-Chew, Su-chow, nor Su-Chow.)

Talkeetna: mountains and river, north of Cook inlet, on the east side of Sushitna river, Alaska. (Not Talkeet, Talkeetno, nor Talkütna.)

Tee: cove or harbor, Lynn canal, southeastern Alaska. (Not Stephens.)

Tulula: creek, tributary to head of Cheoah river, and town, Graham county, N. C. (Not Tallulah.)

Walhalla: plateau, Coconino county, Arizona. (Not Greenland nor Valhalla.)

Winooski: river, tributary from the east to Lake Champlain, Chittenden and Washington counties, Vermont. (Not Onion.)

American Geographical Society.—Transactions, February, 1906.—A Regular Meeting of the Society was held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, February 20, 1906, at 8.30 o'clock p.m.

Vice-President Moore in the chair.

The following persons, recommended by the Council, were elected Fellows:

Courtlandt Nicoll.
Henry DuBois Bailey Moore.
William McDonald.
Thomas A. McIntyre.
Harry Alvan Hall.
William Maxwell.
James M. Lawton.
Howland Pell-Haggerty.
Edwin Stanton Mullins.
R. Stuyvesant Pierrepont.
James H. Penniman.
George Marvin.
Gouverneur Morris Phelps.
I. N. Poe.
Arthur Sachs.
Henry V. Poor.
Allen Merrill Rogers.
Abbott S. Rogers.
Emmet Queen.
Spencer Eddy.
John K. Robinson.

The Chairman then introduced Professor William Morris Davis, who addressed the Society on Experiences with the British Association in South Africa.

Stereopticon views were shown.

On motion, the Society adjourned.

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* Reversal of former decisions.

NEW MAPS.

AFRICA.

CENTRAL AFRICA.—Vias Navegables y Ferrocarriles, Construidos y proyectados en el Africa Central. Scale, 1:10,000,000, or 157.8 statute miles to an inch. *Boletín* of the Madrid Geographical Society, Vol. XLVII, No. 4, 1905, Madrid.

The navigable parts of the rivers are strongly accented, and railroads in operation, under construction, or projected are indicated in red.

CONGO FREE STATE.—Carte Foncière de l'État Indépendant du Congo. Scale, 1:8,000,000, or 126.2 statute miles to an inch. By A.-J. Wauters. *Le Mouvem. Géog.*, No. 52, 1905.

Shows in colours the distribution of the territory of the Congo Free State; (1) regions owned by certain commercial societies; (2) regions of whose exploitation certain commercial societies have a monopoly for a fixed period; (3) land which the State has assigned to the Crown; (4) a region in which three societies are permitted to operate without a concession; and (5) the private domain of the State.

TUNIS.—Carte Routière de la Tunisie au 1er Juillet, 1905.—Scale, 1:500,000, or 7.8 statute miles to an inch. By the Director General of Public Works, Tunis, 1905.

An excellent map of Tunisia, containing not only detailed information relating to all transportation routes, from railroads to camel-paths, post and telegraph offices, lighthouses, etc., but also a generalization of the surface-forms indicated by light and shade. An inset shows the environs of Tunis on a scale of 1:200,000, or 3.1 statute miles to an inch.

TOGO.—Karte von Togo (E. 1 Misahöe). Scale, 1:200,000, or 3.1 statute miles to an inch. *Mitt. aus den deutschen Schutzgebieten*, Band XVIII, Berlin, 1905.

Another sheet of the 10-sheet map of Togo, based upon trigonometrical and topographic surveys. Dr. Gruner says that the accurate topographic detail collected cannot all be shown even on this comparatively large-scale map.

LAKE CHAD REGION.—Der Deutsche Logone und seine Nachbargebiete. Scale, 1:750,000, or 11.84 statute miles to an inch. By M. Moisel. *Mitt. aus den deutschen Schutzg.*, Band XVIII, Berlin, 1905.

The map is based upon unpublished surveys and astronomically-determined positions. It gives a good idea of the junction, at high water, of the Niger and Shari basins through the Tiburi swamp. An inset gives the plan of Dikoa on a scale of 1:10,000, or 0.1 statute mile to an inch.

LAKE CHAD REGION.—Das Tschadsee-Gebiet. Scale, 1:750,000, or 11.84 statute miles to an inch. By H. Marquardsen. *Mitt. aus den deutsch. Schutz.*, Band XVIII, Berlin, 1905.

Accompanies an article on the exploration of this region by the Yola-Lake Chad expedition. Shows the distribution of forest and scrub around the lake, the extent of the coasts that are flooded at high water, the parts of the lake that are covered by water plants, and the lagoons that are periodically dry or cut off from the lake.

AMERICA.

U. S. GEOLOGICAL SURVEY MAPS.

Geologic Atlas of the United States. Washington, D. C., 1905.
No. 124. Mount Mitchell Folio, North Carolina–Tennessee.
No. 126. Bradshaw Mountains Folio, Arizona.
No. 127. Sundance Folio, Wyoming–South Dakota.
No. 128. Aladdin Folio, Wyoming–South Dakota–Montana.
No. 129. Clifton Folio, Arizona.
No. 130. Rico Folio, Colorado.

Map Showing Pleistocene Deposits of a Portion of Southeastern Wisconsin.—Bulletin No. 273, U. S. Geological Survey.

Illustrates a paper by William C. Alden, in which the data now at hand concerning the drumlins of this region are presented. By far the larger number of drumlins of this area belong to the deposits of the Green Bay Glacier.

Grazing Lands, Western United States (General Location and Area). No scale. Compiled by Albert F. Potter, Bureau of Forestry, U. S. Department of Agriculture. *Bulletin* No. 62 of the Forest Service, Washington, 1905.

Though an expert may figure out the scale of this map without difficulty, it is unfortunate that our Government should issue any maps without providing the common convenience of the natural scale and scale of miles. The map shows the country west of the 100th meridian. Colours indicate the areas of cultivated land, unused desert land, summer, winter, and year-round stock ranges; and also those that are developed by artificial water supplies. This useful map gives a good, general idea of the proportion of each class of land in the different States and Territories.

Preliminary Geologic Map and Sections of Oklahoma Territory. Scale, 20 statute miles to an inch. By C. N. Gould. U. S. Geological Survey, Washington, 1905.

Accompanies Water Supply Paper, No. 148. Contours show the topography upon which the Geological data are imposed.

U. S. HYDROGRAPHIC OFFICE CHARTS.

Pilot Charts of the North Atlantic Ocean, January, February, March, 1906.
Pilot Charts of the North Pacific Ocean, February and March, 1906.

NEW YORK.—Geological Map of the Paradox Lake Quadrangle. Scale, 1:62,500, or 0.9 statute mile to an inch. Bulletin 362, New York State Museum, Albany, 1905.

The geological detail is imposed upon the topographic sheet of this quadrangle, which covers the southeastern part of the Adirondacks. Most of it is within the gneissic area. Illustrates a paper by Dr. Ida H. Ogilvie.

PORTO RICO.—Map of the Island of Porto Rico. To accompany Annual Report of the Bureau of Public Works for the fiscal year 1904–05. Scale, 5 statute miles to an inch. Bureau of Printing and Supplies, San Juan, 1905.

The map, though very roughly executed, shows clearly the general plan of the insular roads completed, under construction, and to be built. About 490 miles of macadamized roads have been built or are under construction.

CHILE.—Comisión Chilena de Límites. Sheets: Coquimbo–Aconcagua; Aconcagua; Aconcagua–Santiago; O'Higgins–Colchagua; Llanquihue. Scale, 1,250,000, or 3.9 statute miles to an inch. Oficina de Límites, Santiago, 1905.

Gives the cartographic results of the surveys of the Chilean Boundary Commission along the main Andean range from 31° to 35 S. Lat., and from 42° to 43° S. Lat. Each of the five sheets includes a degree of latitude and about a degree of longitude, shows the topographical features, and indicates in red the boundary as determined by the Joint Commission. The Aconcagua sheet gives the height of Mount Aconcagua as 22,835 feet, instead of 23,080 feet, as shown in Mr. FitzGerald's map.

DUTCH GUIANA.—Kaart van het Suriname behoorende Stroomgebied van Lawa en Tapanahoni. Scale, 1:500,000, or 7.8 statute miles to an inch. *Tijdschrift* of the Royal Netherlands Geographical Society, Second Series, Vol. XXII, No. 6, Leyden, 1905.

Accompanies a long report on the exploration of the basins of the Lava and Tapanahoni in Dutch Guiana. The confluence of these rivers forms the Maroni River. The Lava River system, forming the eastern sources of the Maroni, is not yet known by that name on the latest atlas sheets. The scale permits the introduction of much detail, as islands, falls, swamps, footpaths, villages of the Bush Negroes and Indians, and also a large amount of information relating to the distribution and heights of the mountain ranges and groups. This is a "mother map," which will be useful for the improvement of our imperfect mapping of the southern part of Dutch Guiana. Insets show profiles of the slope of the Maroni and Tapanahoni Rivers.

PERU.—Mapa de la Provincia del Alto Amazonas. Scale, 1:1,500,000, or 23.67 statute miles to an inch. *Boletín* of the Geographical Society of Lima, Vol. XVII, No. 1, 1905, Lima.

Illustrates an article by C. M. Derteano on that part of Peru mainly east of the Andes and north of 6° S. Lat. The map takes in a large territory in the north claimed by Ecuador.

PERU.—Mapa de los Ferrocarriles del Perú. Scale, 1:4,250,000, or 67.07 statute miles to an inch. *Boletín* of the Geographical Society of Lima. Vol. XV, No. 4, 1904, Lima.

Shows railroads in operation and projected and the proposed line of the Pan-American railroad.

PERU.—Plano de las Secciones y Afluentes del Rio Urubamba. Scale, 1:150,000, or 2.38 statute miles to an inch. By Luis M. Robledo. *Boletín* of the Geographical Society of Lima, Vol. XV, No. 4, 1904, Lima.

A large-scale map of one of the sources of the Amazon indicating many elevations in meters and the velocity of the river in different parts of its course.

PERU.—Mapa Hidrológico. Scale, 15.5 statute miles to an inch. *Boletín* of the Corps of Mining Engineers of Peru, No. 27, Lima, 1905.

Shows areas of canal, artesian, and other forms of irrigation in Peru as far south as 7° S. Lat. This excellent map illustrates an exhaustive monograph on the hydrology of northern Peru.

TRINIDAD.—Sketch of Roads in Trinidad. Scale, 3⅓ miles to an inch. The Crown Lands Office, Trinidad, 1905.

The position of the various ranges of hills is approximately shown, and also the settlements along the common roads, railroads, coasts and streams, so that the map fulfils many of the purposes of a large-scale map.

ASIA.

AFGHANISTAN.—Map of Afghanistan (four sheets). Scale, 1:013,760, or 16 statute miles to an inch. Survey of India, Calcutta, 1905.

This map, which fits into the scheme of a uniform map of the world on a scale of 1:1,000,000, is based upon the latest editions of the Standard Sheets issued by the Survey of India, and includes additional materials derived from other authorities. The scale permits the introduction of much detail that is not found in our Atlases.

CAUCASIA.—Map of Caucasia, Turkey in Asia and Persia. Drawn and Published by the War Topographical Department of the Caucasian Military Division. Scale, 1:680,000, or 10.7 statute miles to an inch. Tiflis, 1903.

Symbols to show towns and settlements according to importance, forts, posts, monasteries, customs houses, rail, waggon, and caravan roads, etc.

CHINA.—(A) Schizzo della Manciuria Meridionale e del Liaotung. Scale, 1:850,000, or 13.3 statute miles to an inch. (B) Porto Arthur. Scale, 1:150,000, or 0.7 statute mile to an inch. (C) Liaoiang. Scale, 1:100,000, or 1.5 statute miles to an inch. *Bollettino* of the Italian Geographical Society, Rome, December, 1905.

These are maps of a large part of the recent scene of hostilities in Manchuria, derived from Russian sources, and giving much more detail than war maps printed for the public contained.

FEDERATED MALAY STATES.—Selangor. Scale, 4 miles to an inch. Compiled at the Revenue Survey Office, Selangor, from actual surveys and various explorations. Revenue Surveys, Selangor, 1904.

The materials enabled John Bartholomew & Co., of Edinburgh, to make a fine map of the State of Selangor, which includes about 3,200 square miles. The information embraces all the place-names, transportation routes, distribution of agriculture and mining lands, many heights above sea-level in figures, and other facts all very clearly expressed.

PERSIA.—Theodor Strauss' Reiserouten im westlichen Persien. Scale, 1:600,000, or 9.5 statute miles to an inch. *Petermanns Mitteilungen*, Jahrgang 1905. Tafel 21. Gotha, Justus Perthes, 1905.

Mr. Strauss has travelled extensively in Western Persia, and this compilation of his map routes contains a great number of hitherto unmapped place-names. The map is based upon route traverses. The author gives a special note upon the pronunciation of place-names. It is noteworthy that his spellings, in many instances, do not agree with those used in the general map of Persia in Stieler's Atlas.

AUSTRALASIA.

NEW GUINEA.—West-Neu-Guinea. Scale, 1:2,000,000, or 31.56 statute miles to an inch. By J. W. Van Hille. *Deutsche Rund. für Geog. und Stat.*, Vol. XXVIII, No. 4, Vienna, 1905.

Illustrates an article on the explorations of Van Hille in Dutch New Guinea in 1902.

AUSTRALIA.—Map of Western Australia. Scale, 1:1,584,000, or 25 statute miles to an inch. (Four sheets.) Office of the Surveyor General, Perth, 1903.

AUSTRALIA.—Map of Western Australia. Scale, 1:3,200,000, or 50 statute miles to an inch. Office of the Surveyor General, Perth, 1905.

In the four-sheet map mentioned above the special features are the definition of the land divisions, gold fields, and agricultural areas by colours. All towns, railroads, telegraph lines, and stock routes are shown.

The one-sheet map gives practically the same information on a smaller scale.

EUROPE.

AUSTRIA-HUNGARY.—Artaria's Eisenbahn- u. Postkarte von Oesterreich-Ungarn. Vierte Neuarbeitung. 6 Auflage, Scale, 1:1,500,000, or 23.67 statute miles to an inch. Artaria & Co., Vienna, 1906. (Price, K. 2.20.)

The latest edition of this superior railroad and postal map, brought up to date and giving cartographic expression to a great variety of information desired by the traveller. Insets show northwest Bohemia, Vienna, Prague, and Budapest on much larger scales, so that, for example, a traveller may easily find the depôt of every railroad entering the large cities.

AUSTRIA-HUNGARY.—Map showing the Races occupying Austria-Hungary. Scale, about 70 statute miles to an inch. *Scot. Geog. Mag.*, Edinburgh, Jan. 1906.

The areas occupied by Germans are tinted red; and red lines show the territorial divisions between the other races. Illustrates a paper on the ethnology of Austria-Hungary by Ralph Richardson.

AUSTRIA-HUNGARY.—The Statistical Bureau of Budapest has issued, in German, a volume entitled "Die Hauptstadt Budapest im Jahre, 1901," in which it gives the census results of that year, and includes a number of finely-executed maps on a uniform scale of 1:45,000, or 0.71 statute miles to an inch, showing the distribution in the city of Roman Catholics, Jews, Hungarians and Germans; also the percentage of inhabitants in each district speaking Hungarian.

EUROPE.—Physik. polit. Schulwandkarte von Europa. Scale, 1:3,000,000, or 47.34 statute miles to an inch. By M. Kuhnert and Prof. Dr. G. Leipoldt. A. Muller-Fröbelhaus, Dresden, 1905.

A school wall-map in which the relief forms are shown by the employment of light and shade, both of which are intensified with increasing height according to a scale of colours printed on the map. Only the most important place-names and railroad routes are given, and the town marks are differentiated according to population. The map presents the broad distinctions between the various land-forms in a clear and vivid manner.

FRANCE.—Carte des Gisements de Coquilles Comestibles de la Côte comprise entre l'Embouchure de la Loire et l'Embouchure de la Vilaine. Scale, 1:80,000, or 1.2 statute miles to an inch. By Prof L. Joubin.

Shows the distribution of edible shellfish along the Atlantic coast of France between the Loire and the Vilaine, and illustrates *Bull.* 59 of the Oceanographical Museum of Monaco.

ICELAND.—Hohenschichten-karte von Island. Von. Th. Thoroddsen. Scale, 1:750,000, or 11.8 statute miles to an inch. *Petermanns Mitteilungen*, Ergänzungsheft No. 152. Gotha, Justus Perthes, 1705.

The map accompanies the first part of a monograph by Professor Thoroddsen on the geography and geology of Iceland. This geographer is widely known for his long studies and surveys in Iceland, which have made the geology, surface-forms, and other features of the interior known to geographers. The elevations of the land are shown by nine tints, ranging from sea-level to over 1,500 meters above the sea. An inset of the island shows the cultivable land, deserts, and lava-covered areas and regions where grass may be found for horses, and glaciers.

RUSSIA.—Die Deutschen in Russland. Scale, 1:10,000,000, or 157.8 statute miles to an inch. By Paul Langhans, With insets showing the German Colonies near St. Petersburg and in Moscow. *Deutsche Erde*, No. 6, 1905. Gotha.

Shows the distribution of the Germans in the various governments of Russia. They are most numerous in an area of Poland south of Warsaw, where they form more than one-tenth of the population.

POLAR.

ANTARCTIC.—Map showing zones of vegetation round the South Pole.' By C. Skottsberg. *Ymer*, No. 4, 1905, Stockholm.

SOUTH AMERICA.—Phytogeographical Map of Fuegia and South Patagonia.

On the basis of P. Dusen's map. Scale, 100 kilometers to an inch. By Carl Skottsberg. *Ymer*, No. 4, 1905, Stockholm.

These two maps illustrate an article by the botanist and Antarctic explorer Skottsberg on the geographical distribution of vegetation in the colder part of the southern hemisphere. The phytogeographical Antarctic chart shows the botanical information in red on a South Polar Chart. The map of the southern part of South America shows the limits of evergreen and deciduous beeches.

ATLASES.

GERMANY.—Bodenanbau und Viehstand in Schleswig-Holstein. Nach den Ergebnissen der amtlichen Statistik. By Th. H. Engelbrecht. 36 sheets and 144 inset maps. Chamber of Agriculture, Kiel, 1905.

Exhaustive information relating to all the agricultural and stock-raising interests is here graphically given in colours.

GEOGRAPHISCH-STATISTISCHER UNIVERSAL-TASCHEN-ATLAS. Von Prof. A. L. Hickmann. 64 pp. of Text, and 64 Tables, Diagrams, and Plates. G. Freytag & Berndt, Vienna, 1905. (Price, k. 4.50.)

This pocket atlas contains 64 sheets of maps, diagrams, and plates, besides 64 pages of text, with a large variety of geographical information, such as the areas and population of the continents, their highest points above sea-level, the largest islands, the most important lakes, the distribution of races and languages, statistical information, etc. The maps are not so finely executed as those in some other pocket atlases, but, on the whole, their information is accurate and up to date. The latest railroad extensions in Africa, for example, are given. The western world and Asiatic countries are very meagrely treated in comparison with Europe. In both maps and text the book contains a very large amount and variety of compact information.

THE OXFORD ATLAS OF THE BRITISH COLONIES (Part 1). British Africa. Seventeen plates in colour. William Stanford & Co., Ltd., Oxford Geographical Institute, Oxford, England. (Price, 2s. 6d.)

The first of a series of atlases embracing the colonies of Great Britain which this firm is now bringing out. Many of the maps are rather rough, but perhaps nothing better can be expected in a quarto atlas of 17 plates selling at retail for a half crown. The first plate is hemispherical, with Cape Town at the centre of projection and parts of the projection extended beyond the hemisphere, to show the relation of South Africa to Australia and our Atlantic ports. The isotherms for Africa are not reduced to sea-level, the object being to indicate the mean temperatures actually experienced in different parts of the continent. The physical map has no differences of tint for heights above 5,000 feet, with the result that no distinction is made between the high Abyssinian plateau and others that are thousands of feet lower; and as for the highest mountains, their elevation is not indicated in any way, On most of the colony maps there is space for much more information than is given, and we miss such desirable facts as the distribution of gold, coal, and diamond mining, etc. A name is occasionally misspelled, as the Sankaru for the Sankuru River. Railroads are especially emphasized on the political map of the continent, but there is no indication of the railroad around the rapids of the Lower Congo, one of the most profitable and successful railroads in the tropics.

BOOK NOTICES.

L'Évolution de la Terre et de l'Homme. G. Lespagnol. Paris, Librairie Ch. Delagrave, 15, Rue Soufflot, 15. (Pr., 5 fr.)

A handbook of general geography, differing in its plan in various respects from that usually followed in similar American publications. It is natural that in the country of Vivien de St. Martin a book on geography should be considered incomplete without an account of the historical development of the science, and the emphasis given to the evolutionary side of the subject, as shown in the mere title, which is quite unique in the application to such a book, likewise requires it. The product of the author's effort does not fall short of his intentions; it will be difficult to find a better presentation, in the same limited space, of the evolution both of geographical discovery and geographical science than that given by him in the 107 pages of the first part of this course. Illustrated by reproductions of famous old maps, these chapters are far from being a dull treatise on things entirely of the past; they demonstrate very well how much the truly scientific conception of a subject gains by the knowledge of its gradual progress from the earliest beginnings to its present state, and richly repay the reader for the trouble taken in learning French. It goes without saying that in a country so famous for its cartographic achievements the explanation of the principles of scientific map-making is included in the discussion of scientific geography.

This discussion culminates in an attempt at a definition of geography which, however, is not fully satisfactory. The author says, indeed, a great deal about the object and purpose of geography, what it does, and what it used to be and no longer is, in much the same way as is done in all the newer books and periodicals. But for a new, brief, and clear definition of what this new geography really is, he leaves us no wiser than we were before, and in fact never gets beyond the start that it is one of the earth sciences.

His division of the special fields of geography, too, seems open to criticism. He distinguishes mathematical, physical, and "human" geography (geography of man), placing the geography of plants and animals as subdivisions with physical geography, and economical geography as part of the geography of man. In the arrangement of his book, however, the author does not adhere to this scheme, for the historical part is followed by (II) mathematical and physical geography including bio-geography), (III) geography of man, and (IV) economic geography. Under this plan the second part comprises about 350 pages, the third part about 80, and the fourth (a large percentage of which is more technological than strictly geographical) about 170. Even aside from this lack of proportion, which does not correspond to the comparative amount of presentable matter in each of the divisions of the science, the classification according to inorganic conditions and organic responses, as practised by the leading American and German geographers, seems to be more in harmony with the development of geographic research in the last decades.

In spite of these objections of a more theoretical nature, the book, both with regard to the choice and the handling of the subject-matter, ranks with the best productions of its kind in any country, and the concise and lucid presentation of the various topics shows at its best the eminently scientific character of the French language, giving an additional interest to the book for a reader who has already become familiar with its contents through the medium of another language. The illustrations, while of uneven merit, are almost always really illustrative, and the excellent résumés of the topics treated which accompany each chapter will prove most serviceable for the more mechanical part of the work. Finally, the carefully-selected bibliographical references on each subject, in which foreign names occur quite as often as French ones, cannot fail to give the student a touch of that broader scholarship which will not be acquired at all by the mere textbook-grinder, and only with difficulty by him whose references are limited by national boundaries.

M. K. G.

Klimalehre der alten Griechen nach den Geographica Strabos. Von Dr. Hans Rid. Kaiserslautern, 1904. Small 8vo. Pp. 62.

It is significant that, with the rapid advance of modern scientific climatology, so much attention should of late have been paid to the views on climate held by the ancients. The recent works of Berger, Kiepert, Tozer, not to mention other authors, have done much to stimulate and interest in the history of ancient geography and related subjects. Among the geographers of the old days Strabo occupies a prominent place, and it is fitting that his contributions to climatology should be considered at some length in the volume before us. It may surprise those who have not some acquaintance with Strabo's writings to know that a small octavo publication of more than sixty pages could be devoted to the views held by Strabo on climate, at a time when the ideas of even the most advanced thinkers were, as a whole, extremely crude in regard to scientific matters. Dr. Rid has, however, in a sympathetic and in no uncertain way, set before us the contributions to climatology which we owe to the man who has been called "the greatest geographer of antiquity." We welcome this little volume to a place beside the latest of the present-day publications on climatology.

Strabo accepted the five-zone division probably suggested originally by Parmenides (see this BULLETIN, XXXVII, 1905, 387-388), but thought that the zone which was believed to be uninhabitable by reason of excessive heat was not as wide as the stretch from tropic to tropic, as had been supposed.

While recognizing the importance of insolation in controlling climate, Strabo appreciated the part played by temperature, by wind and by humidity. He stated the well-known fact that a movement of the air makes high temperatures easier to bear, while a calm makes low temperatures less bitter. An effect of sunshine upon the colour of the skin and in causing the hair to become crinkly Strabo thought possible only when the air is damp. The importance of monsoon winds in controlling climate, and of wind as a health-giving factor, were appreciated. One of Strabo's greatest contributions was his recognition of the control of surface features over climate, whereby *solar* climate is modified into *physical* climate, and his explicit statements regarding the importance of altitude in causing a decrease of temperature. His predecessors had in some cases suggested such a relation, but he himself first clearly discussed it. Latitude was thus shown not to be the sole cause of differences of temperature. The snowline was spoken of, as was the difference in altitude above sea-level at which snow falls and remains on the north and south sides of mountains. Mountains were seen to affect rainfall and to act as climate barriers. The influence of local climates upon the distribution of many plants was recognized.

Among the most interesting of Strabo's views were those concerning the influences of climate upon man. He supported Hippocrates in the belief that weather changes are important in developing physical and mental well-being. He pointed out that nomads are forced to their peculiar mode of life by lack of food and by unfavourable conditions of climate. Mountain peoples are believed to be stronger than lowland peoples, because of the harsher climate in which the former live. The inhabitants of the colder northern latitudes are used to a severe climate. The dweller in the south is soft, and if he goes into a more severe climate cannot endure.

These suggestions concerning Strabo's contributions to climatology will make it plain that we owe much to this ancient writer. Dr. Rid has done well to emphasize the importance of Strabo's scientific work along these lines.

R. DeC. W.

Geografia de la Provincia de Córdoba, por Manuel E. Rio y Luis Achával, Ingenieros Civiles, Catedráticos en la Universidad Nacional de Córdoba. (*Escrita por Encargo del Excmo. Gobierno de la Provincia.*) Publicación Oficial. 2 vols. 8°, and Atlas, in folio. Buenos Aires: Compañia Sud-americana de Billetes de Banco. 1904.

Official publications emanating from the Governments of South-American Republics are, usually, very presentable books. The Argentine especially distinguishes itself, not only in the make-up of its scientific books, but also in the intrinsic value of their contents. The one before us is a fair specimen of official bookmaking in the great Republic of the Pampas and La Plata. Two portly volumes and an atlas in folio, dedicated to the geography of the Province of Córdova exclusively, are certainly well worthy of careful comment. In them, the term "Geography" is taken in its widest sense, as embracing descriptions and statistics of as good as everything connected with the territory mentioned.

The authors, two civil engineers of high standing in their country, have spared no pains in the accumulation and co-ordination of their abundant material. A respectable portion of that material appears to have been gathered (though the fact is not mentioned) by the authors themselves, and the selection made of Messrs. Rio and Achával for the task of preparing this "Geography of Córdoba" is fully justified by the result. It was no small task to do justice to the instructions received from the Executive of the Province, covering as they did, broadly and in the minutest detail, all the subjects of inquiry.

A bibliography, apparently quite complete as far as modern sources are concerned, precedes the text proper. It might, however, have been advisable to include some indications concerning older sources, especially such as are still in manuscript. While we cannot expect to find, in the writings of past centuries, many systematic data, still they often contain allusions which even modern science may advantageously consider. At any rate, where ethnography is included in the material, early history should find its place with proper references to the sources whence knowledge about earliest conditions may be derived. Among the (modern) investigators of the natural history of Córdoba, to which the report alludes, the Germans occupy perhaps the first place, in numbers and in the importance of their achievements; still, there is quite a respectable array of collaborators from the Argentine, as well as from other countries. Full reference seems to have been made to every author, and due credit given to his work.

The descriptions of the physical aspect of the Province are attractive and—what considerably enhances their value—free from the exuberance sometimes disagreeably conspicuous in Spanish-American literature. The few and rare poetic efforts become, through their thorough justification and adaptation to truth, the more pleasing and refreshing.

Situated nearly in the centre of the Argentine Republic, the Province of Córdoba lies between lat. south 29° 30′ and 35°, and long. W. of Greenwich 61° 47′ and 65° 47′. It covers an area of about 175,000 square kilometers (67,570 sq. m.), traversed by several mountain-chains, the highest points of which rise to nearly 2,900 meters (9,500 feet) above the sea. A long list of hypsometric data is given, every one being referred to its source with scrupulous care, which, of course, renders it of solid value. Much attention, also, is shown to the hydrography of the province, in regard to which the most minute care is displayed. The climate of Córdoba having been the object of thorough study on the part of Dr. O. Doering, his work is acknowledged by the authors as their principal basis, whereas the observation tables are taken from the records of the Argentine Meteorologic Office. Many of the tables extend over a period of twenty-five years, and they embrace almost every climatologic feature, ozone included. The distribution of rainfall, as shown by the tables, is interesting through its variety.

It is with some surprise that we note, in a work of such extent and detail, the absence of information on palæontology, whereas the geology of the Province is the subject of reasonable attention. The list of minerals is not only long, but accompanied by observations tending to initiate laymen into a general notion of the minerals enumerated and their value for technical purposes, so far as known. This section of the book is of value to the prospector and miner.

A careful review of the flora and fauna bears out the promise of the bibliographic introduction. In that introduction we already find that, out of seven hundred species of birds known to exist in the whole Republic, 256 are found in the territory of Córdoba. From the section on insects we gather that about a thousand species of Hymenoptera have, so far, been observed in the Province, among which Formicidæ appear with ninety and Mutillidæ with a hundred. Nearly the same number of species of Coleoptera have been recorded, among them 350 Cerambycidæ, Chrysomelæ, and Lamellicorniæ.* Butterflies, however, are rather poorly represented, both in species and individuals, there being hardly more than one-third of the number of kinds of the preceding orders. An interesting observation is that of the comparatively large number of terrestrial molluscs, mostly inhabiting the mountainous districts of the Province, while one species (*Succinea cornea*) dwells in the alkaline regions. The Lamellibranchiæ seem to be represented by a single species, which forms pearls of irregular shape, though of fine lustre, in its cavity.

Political Geography occupies fully one-fifth of the first and two-thirds of the second volume. While the Province is, in size, the second of the sixteen that compose the Argentine Republic, it still embraces but one-sixteenth of the total area of the land. Not quite three persons correspond to every square kilometer. Of the population (about 450,000) but very few are direct remainders of the Indian tribes that held the soil originally. The natives disappeared rapidly, not in consequence of excesses committed by the Spanish colonists, but in the natural course of contact, and on account of their indolence and physical weakness. Only the ferocious Puelches maintain themselves in the extreme south of the Province and were in the last decades of the nineteenth century still a threat to the peaceable settlements of agriculturists. At present the foreign population represents more than twelve per cent of all the inhabitants, whereas the proportion of foreigners to natives, in the Argentine, is one to four. Italians constitute the greatest number of immigrants, then follow the Spaniards and the French. Numerous statistical tables present various phases in touch with the conditions of the people. The lengthy sections devoted to Agriculture, Government, and Laws are valuable to the visitor and immigrant who wishes to inform himself on the chances and drawbacks presented to him in the Argentine.

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* The text has Gamellicorniæ.

The report finally goes over into the geographic description of the Departments into which the Province of Córdoba is subdivided. Much of this being, of necessity, a repetition of the preceding, we forbear entering into details about it. On the whole, the two volumes are a valuable addition to geographic and statistical knowledge, and important to the traveller as well as to intending colonists. While there is, of course, an easily discernible tendency not to diminish the beauty and resources of the Province, it seems to be wholly justified. A handsome Atlas in folio accompanies the very well-printed text. Among South American official publications this one by Messrs. Rio and Achával will always hold a worthy place.

A. F. B.

Ueber die Küstenbildungen des Bottnischen Meerbusens zwischen Tornio und Kokkola. Akademische Abhandlung von I. Leiviskä. Helsingfors, 1905. K. Malmström, Publisher. 225 pp. Two maps.

The coast of Finland between Tornio and Kokkola—viz., between 64° and 66° N.—differs from other parts of the coast of the Gulf of Bothnia through the lack, or very limited number, of islands. While a general family resemblance is evident in all parts of the region described, its features present some perfectly distinct types. Sometimes a great number of them are crowded together on a limited area, sometimes the character of the coast remains unchanged for many miles. Upon the basis of a minute study of every part of the coast from Kokkola to Tornio, the author gives a classification and explanation of the various types. Examining the larger or smaller number of bays, necks, and islands, their shapes, the steepness of the coast, the material of which it is built, etc., the author distinguishes five principal types—meadow, pasture, sandy, stony, and rocky coasts.

1. Meadow coasts occur on sandy and clayey shores. The sand meadows occur (*a*) in open bays, near the mouths of rivers; there the sand is purest, and a gentle surf arranges it in long sandbanks and lagoons, or swamps, alternately; (*b*) in sheltered bays, on gently rising shores, on which the meadow generally passes into groves and forests. Here the sand is freely mixed with clay. Clay meadows, on the other hand, occur in shallow water where there are no rivers, and the coast is rich in low islands separated by shallow channels. It is on these meadows that are found the so-called "barren polygons"—a formation due to the cracking of the clay in dry weather and the rising to the surface, along the cracks, of salt water which evaporates and leaves salt crystals all along the cracks, thus covering the soil with a network of white polygons.

Substages of the meadow coast are the shrub coasts, narrow strips of meadow covered with shrubs, and the bluff coast, due to erosion.

2. The pasture coasts are distinguished from the first type by the occurrence

of boulders and vestiges of forests, and they are classified as sand pastures with a sandy, and boulder pastures with a clayey, soil.

3. Sandy coasts occur only on the open ocean, not in bays. They are either wide sand beaches or narrow strips of sand before a rocky coast, running straight or in a curved line, and are always accompanied by parallel ridges of dunes running also straight or curved, respectively. It is very significant that a long plateau of sand always extends from such a coast out into the ocean, and that, contrary to (*a*), they appear absolutely independent of the mouths of rivers. This would contradict the statement of Sokolow that the distribution of permanent dunes on the coast coincides with the arrangement of river mouths, whither sand is transported by the rivers. Here it seems that the submarine sand plateau furnishes the material for the dunes, each incoming wave depositing a load of sand on the shore and the undertow washing the light particles again out into the sea. On a rising coast like this one, the continuous gain of land and the parallelism of the dunes to the shore seem to correspond very well in support of this theory.

4. The stony coasts are either pebble coasts, along the shores of necks and on the outside shores of islands, or boulder ("block") coasts on the inner sides of the bays. They are but partly of glacial origin; much credit for their existence must be given to the transporting powers of coastal and river ice in this region. One can easily tell the two kinds of deposits by their scratches, those of the recently-transported material being more superficial and less regular.

5. On the rocky coasts proper, granite and gneisses appear in more or less rounded hills, both as hills on the land and as islands in the ocean. Where the waste has connected the islands with the mainland and among themselves, a beautiful forested coast is the result. The same care as under 4 must be taken in attributing the shape of these hills to glaciation alone. While they are unmistakably *roches moutonnées,* their original curvature is very probably due to rock structure. It has been observed that this particular granite has a distinct tendency to break in concentric layers, and thus glacial action is probably responsible only for the final polishing and the scratching of the rock.

Of terraces, none but pseudo-terraces are found, either where in front of a pebble or boulder wall a narrow strip of meadow has been formed, or where on the shore meadows the action of the waves has worn out a bluff with a beach below.

The hardness and shape of the subsoil determine the topography of the region to this day, with the only exception of a depression in the central part of the coast where the rock surface is so low that considerable deposits of sediment were made in the stage of submersion, and their shape is now determined by the action of the waves and rivers. Even the islands, however, are nothing but elevations of bed rock clothed with sediments, and both the bottom of the sea and the surface of the back country repeat the same general lines of structure which are exhibited on the coast.

The book is illustrated with a large number of excellent photographs, and is a valuable contribution to the geography of Finland, as well as to the geography of the coasts in general.

M. K. G.

British Rainfall.—Few meteorological publications are more widely known than *British Rainfall,* a report which is unique in meteorological literature. The forty-fourth volume has been reached, and bears the date 1905. Dr. H. R. Mill, the present compiler of the report, succeeded the late Mr. G. J. Symons, who organized the British Rainfall service, and edited the annual volume for thirty-nine years. The peculiarity of this rainfall organization is its voluntary, unofficial character. By years of continued hard work Mr. Symons was able to build up a system which embraced all parts of the British Isles, and brought together a remarkable series of rainfall records, and the support of this service was obtained through the voluntary contributions of its observers. Dr. Mill is carrying on the work with unswerving devotion to the ideals of its founder. The present volume contains data supplied by 3,982 rain gauges, set forth in the usual way. In addition, there are original articles on the rainfall of Ben Nevis, and other matters of more local British interest. A valuable part of the report is a discussion of *Heavy Falls on Rainfall Days in 1904*, in which the paths of the cyclones which brought these heavy rainfalls are charted, together with the rainfall distribution. This makes it possible to study the relation of precipitation to the cyclonic unit, rather than to the daily or monthly unit. R. DeC. W.

Commercial Geography. By Henry Gannett, Carl L. Garrison and Edwin J. Houston. vi and 440 pp. 185 Figures and Index. The American Book Company, New York, 1905.

Gannett, Garrison and Houston's Commercial Geography is the latest addition to the rapidly-increasing number of commercial texts for use in high schools, and is in many ways a striking contrast to most of its American rivals. Commercial Geography has not been taught long enough in this country for experts to come to an agreement as to what the subject should include or what emphasis should be given to the different phases. Two plans prevail as to the content of texts. Under one plan, illustrated in the well-known books by Adams and Trotter, a brief consideration is given to the general principles of the subject, and the rest of the space is devoted to Regional Commercial Geography.

Redway's Commercial Geography and the book under review follow the other plan, evidently adapted from the English master Chisholm, of dividing the treatment into three parts—Commercial Conditions, Commercial Products, and Commercial Countries.

The proportionate space given to these different phases in the five leading texts is indicated by rough percentages in the following table:

GENERAL PRINCIPLES.		COMMODITIES.	REGIONS.
Adams........	10%	—*	90%
Trotter........	12%	—	88%
Redway.......	22%	28%	50%
G. G. & H....	20%	20%	60%
Chisholm......	13%	27%	60%

For practical purposes the general plan followed in the book under review is probably the best, though it involves such a condensation of material that the study of the text leads to memory work rather than to a realization of the principles of commercial geography.

The authors have given a good summary of the conditions determining commerce, with a better emphasis of the economic determinants than is found in any other American book. The physical side is, on the other hand, fragmentary, and somewhat unsatisfactory. The treatment of products is generally well done, though it would have been improved if many of the products of lesser importance had been omitted. The regional treatment is good. The book is supplied with an excellent series of percentage diagrams and black-and-white distribution maps. The statistical tables are well selected for reference work, and the index is full and most serviceable.

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* About 40 per cent. of Adams's book, including product maps, is given to commercial products. As the general principles of commercial geography are not confined to the first six chapters, but are applied throughout the book, the bases of the subject occupy much more than 10 per cent. of the space.—Editor.

The volume is excellent for a trained teacher who has a good laboratory equipment to be used in a supplementary way. We have tested the results of the book in one instance and found a large amount of information of unrelated facts and little real knowledge—a condition that might arise with even an ideal book in the hands of an untrained teacher. In many ways the volume is the best in the market, and is a step in advance. For classes in the later years of a high school we should prefer a volume with a little more emphasis of causes and consequences and fewer details. R. E. D.

Zur Kunde der Balkanhalbinsel. Reisen und Beobachtungen. Herausgegeben von Dr. Carl Patsch.. Heft 1. Eine Reise durch die Hochländergaue Oberalbaniens. Von Karl Steinmetz. 66 pp., 13 Illustrations, and Route Map. Heft 2. Aus Bosniens Letzter Türkenzeit. Von Dr. Josef Koetschet, vii and 109 pp., with portrait of Dr. Koetschet. Heft 3. Ein Vorstosz in die Nordalbanischen Alpen. 60 pp., 10 Illustrations, and a Map. A. Hartleben, Vienna, 1904–1905. (Price, M. 2.25 each.)

The publishing house of A. Hartleben is to be commended for beginning the publication of this series of travels and observations in the Balkan Peninsula, for they promise to throw some new light upon this obscure part of the world. In his travels in the mountain region of northern Albania, Engineer Steinmetz, for example, almost within sight of Scutari, fell in with phases of life that would seem more characteristic of some earlier century. Girls and women on the road were bending under heavy burdens which they were carrying to the market towns. Men, on the other hand, carried only their fine rifles. The explorer saw only one muzzle-loader among the mountaineers, who are fully abreast of the times in the value of their guns.

The first night out from Scutari Steinmetz became accidentally the guest of the celebrated outlaw, Kin Matija, who lives by nightly forays upon the plain dwellers, and seems to live in perfect security among his mountains, though the Turkish Government has set a price on his head.

Among these mountains the first questions that all men asked Steinmetz were, "Who are you?" and "Where did you come from?" He thought it most fortunate that in this lawless land there is an unwritten law which is protective in its effect. In whatever house he ate a piece of bread, or even drank a glass of water, he was henceforth a friend of that house, and any injury to him would probably be avenged.

Steinmetz's two journeys were in the basin of the middle and lower Drin, which had already been studied on the geographical side by Hassart, von Östreich, and Consul General von Ippen. The explorer's two maps show a region divided by parallel ranges, and deep, very narrow valleys, into natural mountain districts, where it would be very difficult, without large sacrifice, for the Government fully to impose its authority upon the people. Steinmetz comments on the barrenness of the upper parts of the mountains and the distances of the small settlements from one another.

Le Origini degli Stati Uniti D'America. Gennaro Mondaini. pp. xvi + 460. Ulrico Hoepli, Milano, 1904.

The physiographic description of the territory of the United States that opens this well-intended volume is concise, but quite sufficient for the scope of the book. The chapter about the Moundbuilders might have been shorter for what it really contains, as in statements like these: "Edifices constructed on the tops of hills and containing as many as 5,000 persons"; and, "Or are these the monuments of that great civilized empire founded, as the Iroquois tradition tells, by the Indian tribe of the Lenni Lenape, who came into the valley of the Mississippi from the North-west, and were driven out by more barbarous peoples, who forced them to take refuge in the most inaccessible *cañons*, where are still found remains of extraordinary buildings?"; or, again, "finally Morton, with perhaps sounder judgment than any, attributes them to that Toltec type represented by the primitive inhabitants of Mexico—a type physically distinct from the true North American, because it is dolichocephalic rather than brachycephalic."* (Pp. 21 and 22.) These show that the author still comfort ably reposes in what was once thought to be true. To the same class of information belong the discourses about the "Great Spirit" of the American Indians (p. 25).

As with the overwhelming majority of European writers on these topics, a guileless faith in the knowledge of our forefathers characterizes the author's point of view and leaves it an open question whether the briefness of his remarks on the subject of the primitive inhabitants of North America might not, perhaps, have been more decided. The same kind of "archaic" knowledge is displayed in the short review of Spanish attempts at colonization of the North American coast.

Mondaini's conception of the merits of Puritan colonization is not always impartial. The great influence which the Puritans have exercised over the development of what is now the United States appears to him a logical sequence of the principles of Puritanism. But he is not an admirer without reserve, for he remarks (p. 80): "If this rigidity, which soon degenerated into an intolerance that prohibited everything 'but marrying and making money,' renders the Pilgrims less attractive to us, it is certain, on the other hand, that this sovereign contempt for whatever gladdens and embellishes life contained within itself the assurance of success in that hard country."†

The maxim to "marry and make money" has, as far as the second part of it is concerned, become one of the strongest survivals of Puritan influence in this country. In regard to the first part there have been modifications, to which the tendencies of the "Puritan forefathers" are not altogether foreign.

Handsome is the tribute paid to Roger Williams, and without a consequent stringency towards the intolerability or intolerance of the Puritans. Mr. Mondaini's admiration for the latter leads him to attribute to them almost every noticeable feature or deed with which the people of the United States can be credited.

Whereas, in the second chapter, the author has hardly sufficient praise for the Puritans, in the third the colony of Jamestown, Virginia, is roughly handled. He calls the founders of that colony adventurers of the worst kind ("Erano essi avventurieri della peggior specie), and similar "names," that show his ultra-democratic, not to say socialistic, inclinations, and detract henceforth much from the value of the little work. Hereafter Mondaini far exceeds George Bancroft, in the latter's Apology of Puritanism called, by title and courtesy, the History of the United States. He is manifestly a sincere socialist who, however (even in case he visited the United States), has not penetrated beyond the surface, and is imbued with sympathies and ideas becoming more and more antiquated. Distance has lent enchantment to his view; and while there is no sign in his book of any overdose of "book-learning," the almost exclusive reliance upon sources of a certain kind greatly mars the importance of his otherwise well-meant effort.

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* "edifici costrutti in cima ai colli e contenenti persino 5000 persone," and "O sono questi i monumenti di quell' impero grande e civile fondato, come suona la tradizione irochese, dalla tribù indiana dei Lemni Lenapi, scesi dal nord-ovest nella vallata del Mississippi e scacciati di qui da genti più barbare, che li avrebbero costretti a cercare rifugio nei più impraticabili *cañons*, dove pur trovansi vestigie di costruzioni stranissime?" Or "il Morton infine, con più ragione forse d'ogni altro, li attribuisce a quel tipo Tolteco, rappresentato pure dagli abitanti primitivi del Messico, tipo distinto fisicamente da quello nord-americano vero e proprio per essere dolicocefalo anzichè brachicefalo."

† Se questa rigidità, degenerata ben presto in una intolleranza che tutto proibiva se ne eccettui "maritarsi e guadagnar denaro," ci rende meno simpatici i Pellegrini, certo è d'altra parte che questo disprezzo sovrano per quanto allieta ed abbellisce la vita portava in sè la garanzia del successo in quel rude paese...

A good Italian translation of the Declaration of Independence and of the Constitution of the United States is appended. A. F. B.

La Republica Argentina, nelle sue Fasi Storiche e nelle sue attuali Condizioni Geografiche, Statistiche ed Economiche, di Ezio Colombo. Con Tavola, Carta, e Indice dei Nomi. pp. xii + 330. Ulrico Hoepli, Milano, 1905.

This little book is, in fact, a guide to immigrants; and if we consider that between the year 1857 and the end of December, 1902, more than two millions of foreigners settled in the Argentine (of whom nearly one million three hundred thousand were Italians), the timeliness of such a booklet becomes quite apparent. At present one-third of the inhabitants of the country are Italians or descendants of Italians. Among these, fifty per cent. are from southern Italy; next in numbers come the Genoese. Of the latter the book very justly says: "To tell the truth, there is no corner of the New World into which they have not penetrated." This is especially true of the western coast, where the Genoese began to arrive in the fifth decade of the past century, and in greater numbers since 1849 in California. As an element of advantage to the country, the northern Italians (Piedmontese, Lombards, and Venetians) are placed in the foreground, being generally tillers of the soil; whereas the southern Italians form a rather floating population, and the Genoese have almost monopolized the higher branches of finance and commerce.

True to the special task which the author seems to have proposed to himself—to wit, that of making his countrymen acquainted with the Argentine, its resources, and inducements for immigrants—he goes on describing the land, after giving a sketch of its political history. This résumé is well co-ordinated, and its tone is quite impartial. The short allusions to the primitive ethnography of the country are, while not always strictly exact, still satisfactory on the whole. There follow chapters on economical questions, concise but correct pictures of the Fauna and Flora, on Geology and Mineralogy, interesting chapters devoted to Orography and Hydrography. The second half of the little volume contains the descriptions of the various provinces, and, appended, a catalogue of works advertised in the *Manuali Hoepli*, published at Milan. As a guide the book is of a superior type; it bears a decidedly scientific character of the popular kind, and is useful, not only to those who consult it for purposes of emigration, but to the general reader and student of geography and natural history. A. F. B.

The Coal-Fields of Great Britain: Their History, Structure, and Resources. By Edward Hull. Fifth Edition, Revised. xxii and 472 pp., 15 Maps and Illustrations and Index. Hugh Rees, Ltd., London, 1905. (Price, 14s.)

The new edition of this authoritative work is welcomed as supplying the latest information on the subject. The book embodies the results arrived at by the Royal Coal Commission of 1904, describes, in addition to the coal fields of Great Britain, those of the Indian and Colonial Empire and of other parts of the world, and contains small maps of the various British coal fields. The author shows that the increase of temperature in coal mines must be overcome by artificial means when the depth exceeds 3,000 feet, where the temperature of the earth is about 98°. It is assumed that a depth of at least 4,000 feet may ultimately be reached in coal mining.

Austria-Hungary, including Dalmatia and Bosnia. Handbook for Travellers. By Karl Baedeker. Tenth Edition, Revised and Augmented. xviii and 468 pp., 33 Maps, 44 Plans, and Index. Karl Baedeker, Leipzig, 1905. (Price, M. 8.)

This compact guide-book is adapted for a pocket of moderate dimensions. For purposes of description the empire is divided into ten districts, each of which has a section in the book ; and any section may be separately removed from the volume. The maps and plans of Wagner & Debes are unusually numerous, and special care has evidently been bestowed upon them.

Tom Petrie's Reminiscences of Early Queensland (dating from 1837). Recorded by his Daughter. xv and 320 pp., 17 Illustrations, and a List of Places, Names, etc. Watson, Ferguson & Co., Brisbane, 1904.

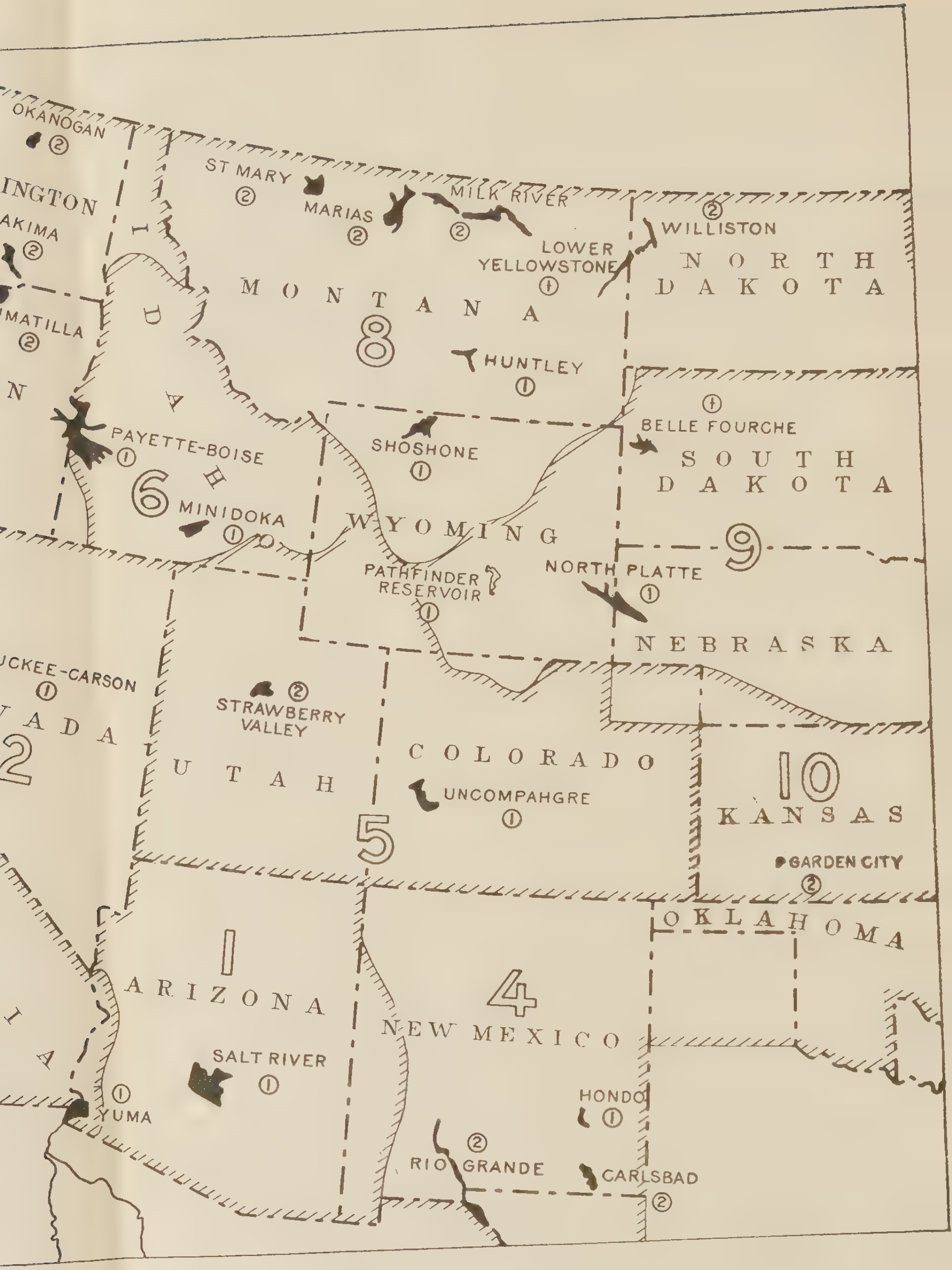
Mr. Petrie was taken to Queensland in 1837, and was intimately associated with the aborigines of that colony from boyhood. His records of their customs, traditions, and folklore have undoubted ethnological value. His knowledge of these primitive people was intimate and profound, and his daughter has rendered a service in thus perpetuating in book form these graphic memories of the old Brisbane blacks, who have now practically died out. Two-thirds of the book is given to descriptions of the life and ways of these blacks, in whose trustworthiness, if well treated, and other good qualities Mr. Petrie has more confidence than most of the white immigrants. The remainder of the volume gives many incidents of those pioneer days, in which both whites and blacks took part.

Mr. Petrie, on one occasion, accompanied the explorer Leichhardt through the bush and helped him to collect plants and seeds. It was not long after that Leichhardt and his comrades entered the unknown interior, and no particulars of their fate have ever been received.

Unter Chinesen und Tibetanern. Von A. Genschow. 384 pp., 189 illustrations, and 6 maps. C. J. E. Volckmann, Rostock i. M., 1905. (Price, M. 6.)

The author, an interpreter, travelled south from Peking to Hankow, up the Yangtse to Ichang, over the mountains on the south side of the Yangtse to Lichwang and on to Tibet and Burma by way of Talifu, in Yunnan. In the western part of China, as far as Tali, he travelled over some new ground, and added new facts to the descriptive literature of that region. The routes he chiefly followed, however, are fairly well known. The narrative is full of incident, and the book gives a rather graphic picture of the people and the regions visited. Many photographs help the text.

United States Dictionary of Altitudes.—The fourth edition of this important work contains 1072 pages, and is thus very greatly enlarged over the earlier issues. The rapidly multiplying bench-marks of our Topographic Survey and the large number of new determinations by railroad companies have caused this great addition to the number of ascertained altitudes. They are arranged alphabetically under the States and Territories, with the authority for the height given in each case.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PAYETTE-BOISE ①
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MINIDOKA ①
SHOSHONE ①
BELLE FOURCHE ①
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PATHFINDER RESERVOIR ①
NORTH PLATTE ①
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UCKEE-CARSON ①
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GARDEN CITY ②
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SALT RIVER ①
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NATIONAL RECLAMATION OF ARID LANDS.

BY

C. J. BLANCHARD.

The year just closed was marked by substantial progress in the work of national reclamation of arid lands. Important structures have been completed, several of the largest engineering works ever attempted in this country are under construction, and detailed plans have been prepared and approved for other works of similar magnitude. The preliminary surveys and examinations, which involved much time and labour, are practically concluded. Out of nearly 100 projects examined, all but 24 have been eliminated for the present, and during the next three years the engineers will concentrate their entire attention upon the building of these great works.

Additions to Personnel.—The magnitude of the works proposed and the opportunity offered for achieving national reputation have made it possible to add to the already strong personnel of the Service a number of noted engineers, although the emoluments of a Government position are neither commensurate with the value of their services nor comparable with what they would obtain from private practice.

Among the new engineers are Carl E. Grunsky, consulting engineer, D. C. Henny and Charles E. Wells, supervising engineers—the former for Oregon and Washington, the latter for southern Wyoming and South Dakota; F. C. Horn, constructing engineer, Minidoka dam; E. D. Vincent, constructing engineer, Laguna dam.

The Reclamation Fund.—Sales of public lands for the fiscal year ended June 30, 1905, netted the Reclamation Fund $4,757,578.87, which, added to the amount in the Treasury, makes a total of $28,028,571.50. The estimated increment to the fund for the years 1906, 1907, and 1908 is $9,000,000, making a total of $37,028,571.50, which will be available for irrigation work during those years.

The allotments now made and the proposed allotments to various States and Territories in the order of their magnitude are as follows:

ARIZONA	Salt River		$3,850,000.00
NEBRASKA–WYOMING	North Platte		3,330,000.00
MONTANA	Huntley	$ 900,000	
	Lower Yellowstone	1,200,000	
	Milk River	1,000,000	
			3,100,000.00
OREGON	Klamath	$2,000,000	
	Umatilla	1,000,000	
			3,000,000.00
CALIFORNIA–ARIZONA	Yuma		3,000,000.00
NEVADA	Truckee-Carson		3,000,000.00
IDAHO	Minidoka	$1,300,000	
	Payette-Boise	1,300,000	
			2,600,000.00
COLORADO	Uncompahgre		2,500,000.00
WASHINGTON	Okanogan	$ 500,000	
	Tieton	1,000,000	
	Sunnyside	750,000	
			2,250,000.00
WYOMING	Shoshone		2,250,000.00
SOUTH DAKOTA	Belle Fourche		2,100,000.00
NORTH DAKOTA	Pumping Projects	$1,000,000	
	Lower Yellowstone	700,000	
			1,700,000.00
UTAH	Strawberry Valley		1,250,000.00
NEW MEXICO	Hondo	$ 240,000	
	Carlsbad	600,000	
	Rio Grande	200,000	
			1,040,000.00
KANSAS	Garden City		260,000.00
Unassigned balance of estimate			1,798,571.50
			$37,028,571.50

PROJECTS UNDER CONSTRUCTION.

The general map which is published herewith shows the scope of the work, the location of the projects which have been approved, the areas to be irrigated, and the subdivision of the country into districts, each of which is in charge of a supervising engineer.

As before stated, in the sixteen States and Territories 24 projects have been approved, and on 13 of these actual construction is now going on.

Arizona—Salt River Project.—In the order of magnitude and prominence of its engineering features the Salt River project ranks first. Actual construction has been going on since April, 1904, and a commendable progress has been made. The accepted plans for this project involve the construction of one of the highest dams in the world, which will be known as the Roosevelt dam. It will be of uncoursed rubble masonry (sandstone and cement), with arch upstream. It will be 800 feet long on top, 235 feet at the river-bed, and its contents will be 300,000 cubic yards. It will rise 284 feet above the lowest foundation, and the height of water against it will be 230 feet. The location of the dam site is sixty-two miles from Phœnix, at a point just below the junction of Salt River and its tributary, Tonto Creek. The dam will lock a narrow cañon and create one of the largest artificial lakes in the world. This lake will contain 1,400,000 acre-feet, or sufficient water to cover that many acres one foot deep. Its capacity is fourteen times greater than the Croton reservoir, and it will store more water than the Assuan dam in Egypt.

Owing to the inaccessible location of the site, the preliminary work has been arduous and expensive. It was necessary to construct a highway for more than forty miles through an exceedingly broken and rugged country. A large part of the distance is in cañons, and for miles the road is literally hewn out of the solid rock. In many places it hugs precipices 1,000 feet high. The municipalities of Phœnix, Mesa, and Tempe, in order to become supply-points for the army of labourers which will be almost constantly employed on this work during the next three years, contributed $75,000 to defray a part of the cost of the roadwork.

All of this work was done by the Government and not by contract, and a rather interesting feature was the employment of a large number of Apache, Pima, Papago, and Maricopa Indians as day labourers. The experiment was eminently successful, as the Indians proved industrious and faithful, and were especially useful with pick and shovel.

In the construction of the dam 240,000 barrels of cement will be required. The cost of cement, delivered at the dam site by any private agency, would have been almost prohibitive. Owing to a fortunate discovery of the material required for its manufacture near the dam site, it was decided to erect a mill and furnish cement to the contractor. This mill has been in successful operation for several months, and is now turning out 300 barrels a day of first-class cement at a cost which will save the farmers over a million dollars on the first bid submitted by the manufacturers.

The Government has already constructed a power canal, which is supplying the power required for its mill, for the electric lighting of headquarters, etc., and later will furnish 4,000 horse-power to the contractor who is building the dam.

During the early progress of the work the Government operated two saw mills, which cut many millions of feet of lumber from the forest reserves near-by.

In the lower end of the reservoir, on a flat just above the river, is located the thriving little city of Roosevelt, a city of 2,000 people, with water works, electric lights, schools, stores, churches, etc. When the dam is completed the site of this town will be submerged nearly 200 feet. Work on the dam has been greatly delayed by reason of several unprecedented floods, the last of which, in December, swept away all of the false works and much of the machinery of the contractor. The Salt River project will cost $3,850,000, will irrigate from 160,000 to 200,000 acres of land, and will be completed in 1909.

Nevada—Truckee-Carson.—On June 17, 1905, the third anniversary of the Reclamation Act, occurred the formal opening of the first completed work of the Reclamation Service. In the presence of a distinguished body of Congressmen, Governors, legislators, engineers, and others the sluices in the Truckee dam were shut down, the headgates of the great canal were opened, and the waters of the Truckee River for the first time were turned into the Carson River reservoir, from whence long lines of canals and ditches will carry it out upon the desert. (Plate 1.)

The location of this work is in the bed of Lake Lahontan, and embraces what was long known as Forty-mile Desert, one of the most desolate and arid spots on this continent. (Plate 2.)

The great dams on the Truckee and Carson Rivers, the former 110 feet in height, are beautiful and finished products of modern engineering. The long lines of canals, many of them large enough to carry rivers, in places are lined with cement, and obstacles in the route, such as hills, are tunnelled, and the tunnels are cement-lined. Already more than $2,000,000 have been expended on this work. When completed the Truckee-Carson project will cost more than $9,000,000, and will render productive more than 400,000 acres of land now practically worthless, but which, irrigated, will readily sell for $30,000,000. (Plate 3.)

Colorado—Uncompahgre Valley Project.—One of the most spectacular pieces of engineering ever attempted in the West is involved in the construction of the Uncompahgre project in western Colorado. The initiation of this work took place only after engineering ingenuity had been taxed to its utmost in the completion of surveys and plans of structures.

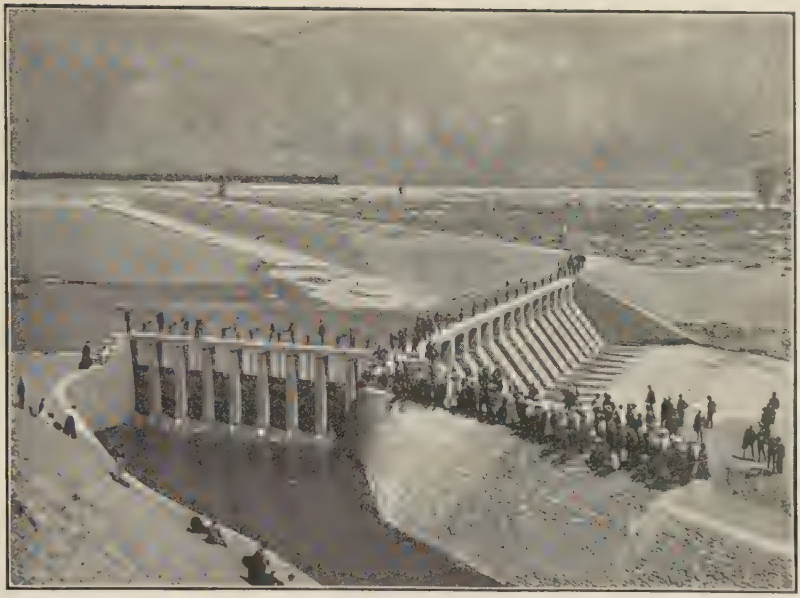

PLATE 1.—COMPLETED TRUCKEE DAM: CANAL OPENED JUNE 17, 1905.

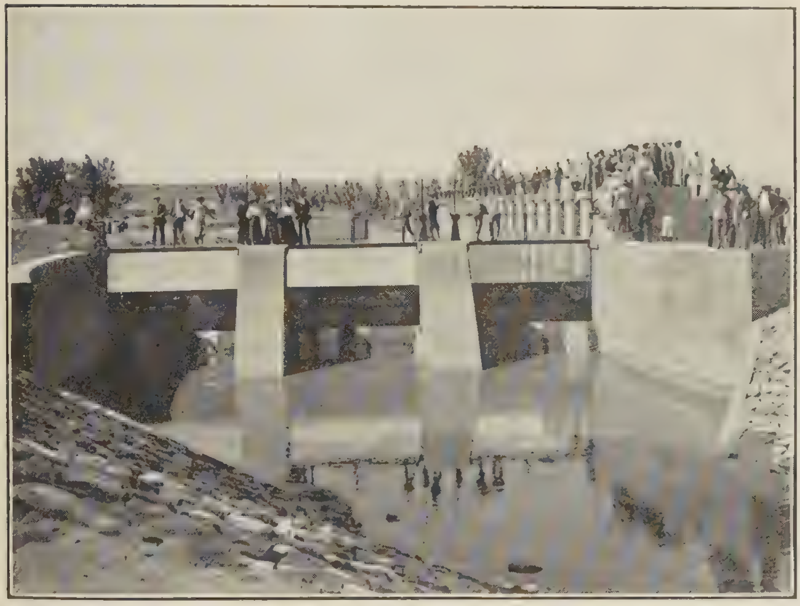

PLATE 2.—CARSON DAM: CANAL OPENED JUNE 17, 1905.

The plans involve the boring of a tunnel with a cross section of 10½ by 11½ feet for a distance of more than 30,000 feet, and passing for the greater part of its length 2,000 feet below the surface of Vernal Mesa. By this tunnel it is proposed to carry the waters of the Gunnison River, now flowing uselessly in a profound cañon, into Uncompahgre Valley, to supplement the insufficient flow of the Uncompahgre River and furnish a permanent supply for more than 100,000 acres of exceedingly fertile land. In the location of a site for a tunnel and a low diversion dam in the Gunnison Cañon, Mr. A. L. Fellows, engineer in the Reclamation Service, performed an act of heroism and daring seldom equalled in the annals of engineering work. Accompanied by one companion, with their kit loaded on an inflated rubber mattress, he passed through the most dangerous part of the Gunnison Cañon, successfully locating a feasible point for diversion and a tunnel site. Following his investigations an extremely dangerous piece of topographic surveying was then completed. This was a survey of about 1,500 feet of the bottom of the Grand Cañon of the Gunnison River, the cañon at this point being approximately 2,000 feet in depth, with precipitous walls. It was necessary to descend into the cañon over cliffs and through narrow fissures in four places. At these points the descent was extremely perilous, and was accomplished only by the use of ropes, over steep cliffs hundreds of feet in height. When the surveys were finished construction was immediately begun upon a roadway leading into the cañon. This road has been completed, the heavy machinery for the power plant is already installed, and the excavation of the tunnel is progressing rapidly. The first mile, or one-sixth of the tunnel, was completed on the 17th day of November.

The Government is doing this work under force account, working three shifts a day of eight hours each on each of the three openings. On the Uncompahgre side the tunnel will connect directly with an elaborate system of canals and ditches extending down the valley on both sides of the river. The completion of this work will add 2,000 homes to the valley, and will increase the taxable wealth of Colorado by not less than $10,000,000. The estimated cost of the whole project is approximately $2,500,000, which must be returned to the Government in not less than ten years after completion by the owners of the lands which are to be irrigated.

Wyoming and Nebraska—North Platte Project.—This project involves the construction of the Pathfinder dam in the cañon of the North Platte River in Wyoming, just below its junction with Sweetwater River. This dam will be known as the Pathfinder, commemorating an episode in the life of the noted explorer Gen. John C. Fremont, who nearly lost his life while attempting the passage of this cañon in a boat.

The dam will have a height of 210 feet, and will create a reservoir storing more than a million acre-feet of water. The actual construction of this dam is well under way. A concrete bulkhead has been built at the western end of the completed outlet tunnel, to control the water during the installation of the gates for the dam. The water stored in the Pathfinder reservoir will be carried in the channel of the stream for many miles, and will then be diverted into the Interstate Canal, having a length of 140 miles and covering lands in eastern Wyoming and western Nebraska. The excavation of the upper forty-five miles of the Interstate Canal was begun in June, 1905, and 33 per cent of the work was completed on January 1, 1906. The North Platte project involves the expenditure of $3,330,000, and will reclaim 100,000 acres of land.

Wyoming—Shoshone Project.—This project contemplates the utilization of a portion of the surplus waters of the Shoshone River for the reclamation of land in the northern part of Big Horn County, Wyoming. It involves the construction of the Shoshone dam, a concrete masonry arch, and the highest structure of its kind in the world. This dam will lock a very narrow cañon, so that in cubical contents it will not compare with any of several other dams, but in its great height it exceeds them all. From bed-rock to top it will be 310 feet high; at its base it is only 85 feet long, and on top only 200 feet. The preliminary work on this structure has been attended with great difficulties, owing to the almost inaccessible location of the dam site and the unexpected conditions which were found in the river-bed. The diamond drills went down 88 feet in places before finding a permanent base, and boulders 38 feet in thickness were penetrated, resting on beds of sand and gravel. (Plate 5.)

As in Arizona, it was necessary to construct a road up the cañon for several miles. This road has been completed, and work is well along on the outlet tunnel and temporary diverting works. When completed the Shoshone project will cost $2,250,000, and will irrigate 75,000 acres.

Montana Projects.—This State is destined to become one of the chief beneficiaries of the Reclamation Act, for the reason, principally, that no other State presents greater opportunities for the development of irrigation projects. Ten feasible projects have been investigated. Of these, three have been approved and funds allotted, and upon two actual construction is under way.

The Lower Yellowstone Project.—This project provides for a diversion dam in the Yellowstone River at a point nineteen miles northeast of Glendive and the irrigation of 66,000 acres in Montana and North Dakota. The diversion dam will be located so as to permit the canal being taken out where it will be protected from the shock of large ice-gorges, which cause considerable damage along the stream every few years. The dam will be a timber-covered, rock-fill, curved face down stream, allowing easy passage of ice and débris during spring floods. The head gates consist of eleven circular openings, 5 feet in diameter, set in reinforced concrete with massive timber-protection. The main canal will be sixty miles long, and will carry 830 cubic feet per second. The cost of the project will be about $1,800,000.

Huntley Project.—Located in the northern portion of the Crow Indian Reservation, in southern Montana, is the Huntley project, which will irrigate 30,000 acres of exceptionally fine land. The water is diverted directly from the Yellowstone River near Billings, and reaches the irrigable lands in about two miles. All of the irrigable area is Government land recently ceded to the United States by the Crow Indians. The works now being constructed and to be completed in 1907 are the following: Main canal, 33 miles long, with three short tunnels in the first two miles; pumping station, 14 miles from headquarters, which will develop power from a 33-foot drop in the canal and irrigate from 3,000 to 4,000 acres of upper bench-land. In addition to the actual cost of construction, settlers must pay the Indians $4 per acre for their land.

Idaho—Minidoka Project.—During the coming summer the engineers expect to turn water from the Government canals upon a large tract of sage-brush land known as the Minidoka tract, in southern Idaho. Work has been steadily going on for nearly a year on the construction of a rock-fill dam across Snake River, and the main channel is now closed. Nearly 100 miles of main canal and laterals are completed, and sub-laterals are being extended to reach every farm in the project. A remarkable transformation has taken place at this point since the beginning of this work. A year ago last spring the writer accompanied the engineer in charge and camped for the night on the banks of the Snake River. Save for our own camp, there was no other evidence of habitation; only a vast expanse of sage brush extending to the horizon on every side. Last October, travelling in a first-class passenger coach over a new railroad, the writer again inspected the tract. He passed through three new towns, containing a total of 120 business-houses, including three newspapers and three banks. On every eighty acres there was a farm house, in which dwelt a family, and where only a little over a year ago all was desolation there now live 4,000 people. The first school house opened with 70 pupils in attendance. All of this development has come in advance of the completion of the works, for not a drop of water is yet available from the canal system. In April the Government will hold an auction sale of town lots, and three new towns will be created in the desert. Excellent opportunities will be offered for investment, with good openings for tradesmen and manufacturers.

Oregon and California—Klamath Project.—Without doubt the Klamath project in southern Oregon and northern California is unique among all the proposed works. It involves irrigation and drainage in unusual combination. The Klamath Basin contains about 400,000 acres of land, 240,000 acres of which are involved in this project. In the tract are three large lakes—the Upper and Lower Klamath Lakes and Tule Lake. Upper Klamath Lake is about 50 feet above the irrigable lands, and furnishes the reservoir and water supply for a large part of the project. Lower Klamath Lake is to be drained by cutting a canal through the natural dike which preserves its present level. Its exposed bed will then be irrigated by canals from the main system. Tule Lake receives its water from Lost River, a winding stream which rises only six miles from where it empties, but covers more than sixty miles in its course. A dam will be built in Lost River, and the waters will be turned into canals to irrigate a large area in the valley. Tule Lake will dry up, and its bed will be divided into farms and irrigated from the main system. The works are simple, and the cost of water the cheapest of any of the proposed Government works. About $4,000,000 will be required to complete the works.

South Dakota—Belle Fourche Project—This project is located in the Belle Fourche Valley northeast of the Black Hills, and will irrigate approximately 85,000 acres, at a cost of about $32 per acre. The works are well under way, consisting of a diversion dam in the river and a large inlet canal connecting with Owl Creek reservoir. A large force of men is now at work on the Belle Fourche dike, the largest earthen embankment in this country. This dike, which closes the outlet to the reservoir, will be 6,200 feet long on top, 115 feet high, and its cubical contents will be 42,700,000 cubic feet, or about one-half that of the Pyramid of Cheops. It will create an artificial lake larger than any body of water in the State. About 65 per cent of the land under this project belongs to the Government, and

PLATE 3.—CEMENT-LINED CANAL, TRUCKEE-CARSON PROJECT, NEVADA.

PLATE 4.—LAYING FOUNDATION FOR LAGUNA DAM, 4,780 FEET LONG: ARIZONA-CALIFORNIA.

settlers are rapidly taking up homesteads. The population of the valley has more than doubled in the last year.

New Mexico—Hondo Project.—The plans and estimates for three projects in this Territory have been approved. Actual construction is well along on one of these, and work will be begun very soon on the others. The Hondo project is one of the minor works, embracing only 10,000 acres of land and involving a cost of $240,000. Rapid progress has been made on the work, and water will be available this spring. The flood-waters of Hondo River are diverted into a storage reservoir having a capacity of 40,000 acre-feet by a canal two miles long. The distributing canal will have a total length of sixteen miles, and will cover a compact body of exceptionally fine land near Roswell.

California and Arizona—Yuma Project.—Especial interest attaches to this project by reason of the great similarity of the lower valley of the Colorado River to that of the Nile in Egypt. Like the Nile, the Colorado River rises in distant mountains and towards its mouth traverses a semi-tropical and practically rainless desert. The valley is subject to annual inundations, the floods depositing immense quantities of rich sediment, which below Yuma have formed a great delta. (Plate 4.)

Prominent features of the engineering work are the Laguna dam across the river and a complete system of levees on both sides of the Colorado and Gila Rivers, to provide against annual inundation of the bottom lands. The Laguna dam is of the East India weir type, and the first of the kind to be constructed in this country. Its length will be 4,780 feet; its height, 19 feet; maximum width, 267 feet. The apron at the toe of the dam will be 50 feet wide, and the total contents of the structure will be 356,000 cubic yards. The dam is of a type unusual in this country, as it rests upon the sand and not on bed-rock. Owing to the treacherous amount of silt carried by this stream, the diversion gates are arranged to draw off only the top foot of water. The sum of $3,000,000 has been set aside for this project, and this will provide for the reclamation of about 85,000 acres, mainly in private ownership.

The length of the growing season at Yuma is twelve months, and the earliest vegetables in the United States are produced here.

Conditions in the Lower Colorado Valley have undergone a remarkable change in the past few years. In 1900 a large canal was constructed near the international boundary to supply several thousand acres in what is known as Imperial Valley, in southern California. Excessive floods in the early spring destroyed the headworks of this system and greatly enlarged the opening. Successive floods increased the size of the canal, and to-day practically the entire flow of the Colorado River is passing through it and northward through old river-channels into Salton Sink. The salt works have been completely destroyed, and the railroad has been forced to rebuild on higher ground. A great inland sea sixty miles long and many miles in width has been created and is rising at the rate of an inch a day. Strenuous efforts have been put forth to force the river back into its old channel, but thus far without avail. The threatened submergence of a large part of Imperial Valley, entailing the destruction of property valued at many millions of dollars and the ruin of nearly 10,000 people who reside there, has attracted the attention of several of the best engineers in the country, who are now endeavouring to find a way to return the Colorado to its channel.

PROJECTS APPROVED.

Washington Projects.—The Secretary of the Interior in December of last year approved three projects in Washington, and set aside the sum of $2,250,000 for their construction. Two of these are located in the famous Yakima Valley and the other in the northern part of the State, on the Okanogan River.

The investigations of the Reclamation Service in Yakima Valley during the past two years indicate that storage can be developed to provide a supply for 300,000 acres, and plans are being made for the construction of a comprehensive system of canals to cover that area. The work is being considered in divisions, each of which, it has been found, can be treated as a separate unit. These divisions are as follows: The Ledbetter Division, 210,000 acres; Sunnyside Division, 40,000 acres; Tieton Division, 24,000 acres; Kittitas Division, 60,000 acres. The engineering works are comparatively simple, and, although expensive, it is believed feasible to extend the Government work to cover this entire area.

Sunnyside Sub-project.—This project involves the purchase, enlargement, and extension of the Sunnyside Canal system, and in connection therewith the construction of suitable storage works at the upper Yakima Lakes, in order to reclaim 40,000 acres of arid lands in addition to the areas now supplied from the present system.

Tieton Sub-project.—This is an integral part of the Yakima Valley system, and provides for the irrigation of 24,000 acres near and west of North Yakima. The water supply will be from the Tieton River, the natural flow of which at all times will suffice for the requirements of the project.

Okanogan Project.—This project contemplates the irrigation of about 10,000 acres of land in the Okanogan Valley. The limited area of the tract and its location in the heart of an extensive range country which would be dependent upon it for its winter feed insure a profitable and permanent market for forage. The lands are well adapted to the production of deciduous fruits and nuts, which yield large returns when cultivated. The present value of non-irrigated land is about $5 an acre; when irrigated it is worth from $40 to $100. Small fruits, vegetables, wheat, and alfalfa are raised. On account of the possibilities for high development the farm unit will be small. A number of small lakes will be utilized as reservoirs by constructing rock-fill dams at their outlets. Five hundred thousand dollars have been set aside for the construction of the works.

Montana—Milk River Project.—Owing to the international features involved in this project, progress has been slow. The plans for the St. Mary dam are now ready, and advertisements for bids are being published. A number of unusual features are noted in this scheme of reclamation which entitle it to especial consideration.

Two important streams, St. Mary and Milk Rivers, rise in northern Montana and flow northward into Canada. The waters of the St. Mary ultimately reach Hudson Bay. Milk River, after continuing in Canada in a general course parallel to the international boundary, crosses back into Montana and empties into Missouri River. The valleys of these streams in this country are markedly dissimilar. St. Mary intercepts a mountain drainage and skirts along the foot of the range, its headwaters being in a region of remarkable glaciers. Milk River drains a broad, gently-rolling country well adapted to irrigation. As St. Mary River cannot be utilized in its own valley in Montana, it is proposed to carry it over into Milk River by means of a canal thirty-seven miles long, and thus augment the insufficient flow of the latter. The international features are due to the fact that Canada is already utilizing the waters of both of the streams, and is now projecting works on Milk River which threaten loss of crops and ruin to several hundred farmers in Montana residing in the lower valley. Canada is using water which rises in this country; and if the comity of nations is to be preserved, some amicable division of these waters must be made at an early date or grave complications are certain to arise. A treaty is being drawn to effect this peaceful settlement. It is believed that the addition of the stored waters of St. Mary River will enable both countries to maintain the present diversions of Milk River, and will also furnish a supply sufficient to irrigate 100,000 acres of new land in Montana. Pending the passage of the treaty, the Secretary of the Interior has authorized the construction of a dam in St. Mary River and the building of a canal through the low divide between the two streams. In the event of failure in making a treaty, it is proposed to use these works for irrigating a large body of land in the eastern part of the Blackfeet Indian Reservation. An allotment of $1,000,000 has been made for initiating this work.

Idaho—Payette-Boise Project.—This project is located in the pleasant valley of Boise River, with the thriving little city of Nampa about the central point. It provides for the reclamation of 372,000 acres, or twice the cultivated area of Rhode Island. The section is noted for its fine climate, and for the wide variety and large yields of its products. At present it has a population of 15,000; but when the Government works are completed it will easily sustain a population as large as Salt Lake Valley, or 120,000 people. The works involve no difficult engineering features, the plans providing for storage on the Payette and Boise Rivers and the diversion of the surplus water of the former into the valley of the latter by means of a large canal cut through the hills which separate the streams. In their entirety the works will cost $9,000,000, and will require several years in construction.

Oregon—Umatilla Project.—One of the smaller of the proposed works is the Umatilla project, in eastern Oregon. While less than 20,000 acres are involved, the favourable climate, the fertile soil, and its adaptability to a very wide variety of crops make this one of the most attractive projects yet undertaken. The land is best suited for orchards and small fruits, and when so used from 10 to 20 acres are ample for the support of a family. The climate is warm, the elevation only 500 feet above sea-level, and fruits and vegetables are the earliest on the market. The transportation facilities are excellent, the markets being the large cities of Portland and Spokane. The engineering works are very simple; and while the cost of water is $50 per acre, this is relatively low when compared with the value of products. The soil experts predict a populous and prosperous community here in a short time after the water is applied to the soil.

New Mexico—Rio Grande Project.—The Rio Grande project provides for the irrigation of 180,000 acres of the rich valley lands along the Rio Grande in New Mexico and Texas. The engineering works involved are the Engle dam, to be built of cyclopean concrete, arched up stream, and 250 feet high. Its length at crest will be 1,150 feet, and at river-level 400. This dam will create an artificial

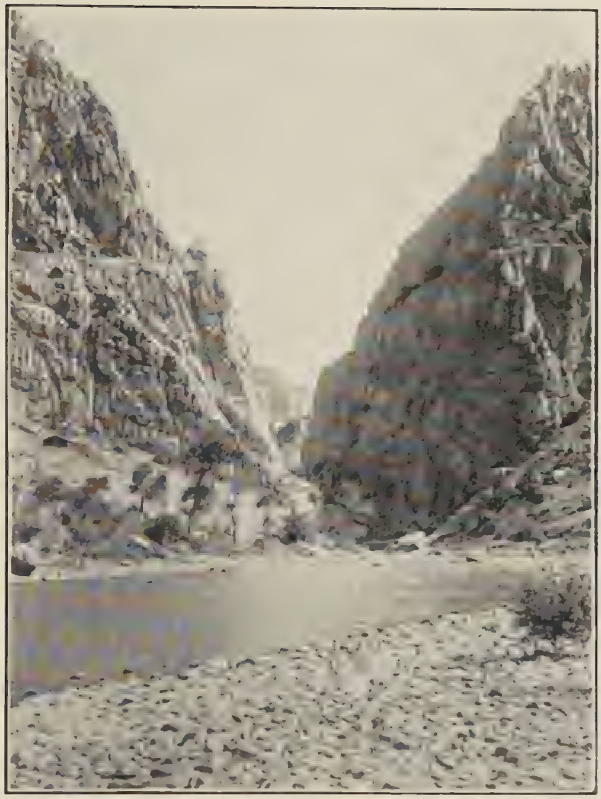

PLATE 5.—SHOSHONE CAÑON SITE FOR A DAM 310 FEET HIGH, WYOMING.

reservoir forty miles long, with a capacity of 2,000,000 acre-feet. As the estimated cost of this project is $7,200,000, it is not probable that the construction of the principal works will be begun for a number of years. The sum of $200,000, however, has been set aside, and authority has been granted for the early construction of the Leasburg Diversion dam and the enlargement of the Las Cruces Canal, a unit of the main project. Settlers in the valley have given guarantee to the Secretary of the Interior that they will repay this amount within two years after completion. These works are necessary to provide water for some 40,000 acres of land which, owing to the recent destruction of the old canal system, are now absolutely without water supply. It is believed that the construction of the entire project will bring about a settlement of the numerous controversies over water rights which have disturbed the relations of this country with Mexico, and which have continued for many years between the citizens of New Mexico and Texas.

Carlsbad Project.—The sum of $600,000 has been appropriated for the purchase, extension, and enlargement of the present irrigation system on the Pecos River near Carlsbad. In October, 1904, a great flood swept away the Avalon dam and caused severe damage to the irrigation system. The owners, finding themselves unable to make the necessary repairs, made overtures to the Government to dispose of their holdings, and the owners of land in the valley contracted to repay the cost of the new works. Contracts are being advertised, and the work will begin as soon as the bids are awarded. About 15,000 acres are involved, all of which is in private ownership, much of it being under cultivation and in orchards.

Utah—Strawberry Valley Project.—This project embraces an area of about 50,000 acres of land in central Utah, situated from five to fifteen miles south of the town of Provo and on the eastern shore of Utah Lake. In its engineering features it is very similar to the Uncompahgre Valley project, as it involves the construction of a tunnel about four miles long passing under the divide and carrying the water from a reservoir in Strawberry Valley into the Spanish Fork River, from which a canal eighteen to twenty miles long will convey it to the irrigable area. Plans are approved, $1,000,000 have been set aside from the fund, and actual construction will commence as soon as the weather conditions will permit.

Kansas—Garden City Project.—The first approved project of the Government which involves pumping is at Garden City, where water is to be lifted from a line of wells extending across the valley a total distance of 24,000 feet, to supply 15,000 acres of land just east of

Deerfield. The proposed plant is designed for the recovery of underground waters, and involves the construction of twenty-three pumping stations, each driven electrically from a central power station. The maximum daily capacity of the pumping plant for 150 days will be 150 second feet, and the mean daily capacity will be 100 second feet. The estimated cost of the project is $237,000. Power will be developed from Colorado lignite costing $3.50 per ton, in a pressure gas-plant, the power being distributed by direct current meters at the pumping station.

North Dakota Pumping Projects.—Four feasible pumping projects have been located in North Dakota in the semi-arid portion of the drainage basin of the Missouri River and its tributaries. Plans are well advanced on two of these, and it is expected that work will commence early this spring.

Williston Project.—Williston is located in the centre of this project, which provides for the irrigation of about 14,000 acres, the contemplated lifts to the several canals being approximately 40, 60, 80, and 100 feet.

Nesson Project.—Located on the north bank of the Missouri River, it includes an area of 20,000 acres.

Buford-Trenton Project, twenty miles west of Williston, covers a series of flats aggregating about 25,000 acres.

Bismarck Project, located just west of Bismarck, covers about 20,000 acres extending south along the Missouri River.

On these projects both steam and electric power will be used, which will be developed from lignite coals, immense quantities of which are found near-by in beds from an inch to 40 feet in thickness. The sum of $1,000,000 has been allotted for initiating these works.

A résumé of the work performed by the Reclamation Service to date shows that 92 miles of main canal, 76 miles of distributing system, and 265 miles of ditches have been constructed, including dams, headworks, etc. Tunnels having a total length of 3 4-5 miles have been driven, including more than a mile of the great Gunnison tunnel. More than 265 miles of telephone lines have been installed and are in operation; 127 miles of wagon road, many miles of which were cut out of solid rock in almost inaccessible cañons, 150 bridges, and 80 office and other buildings have been constructed.

The works above mentioned have called for the excavation of 11,500,000 cubic yards of rock and earth, the laying of 70,256 cubic yards of concrete, 15,329 cubic yards of rip rap, 260,000 square feet of paving, 27,549 linear feet of sheet-piling, and 12,200 feet of bearing piles have been driven. There have been purchased 131,000 pounds of railroad iron, 265,000 pounds of structural steel, 959,000 pounds of cast iron, 2,163,000 feet B. M. of lumber, and 86,442 barrels of cement. The Government has erected a cement mill at a cost of more than $100,000, which has already turned out 20,419 barrels of cement, and is now furnishing about 300 barrels a day. The saw mills operated have cut 2,889,000 feet B.M. of lumber from the Government reserves.

THE INTERDECENNIAL STATE CENSUSES.

BY

HENRY GANNETT.

Since the United States Census of 1900, fourteen States have made enumerations of population—namely, Michigan in 1904, and Florida, Iowa, Kansas, Massachusetts, Minnesota, New Jersey, New York, North Dakota, Oregon, Rhode Island, South Dakota, Wisconsin, and Wyoming in 1905. Reports on all of these have been made public with the exception of Florida and Oregon.

The following are the figures of population by these State censuses, with the increase since 1900 and the percentage of increase:

POPULATION BY CENSUSES, WITH INCREASE OR DECREASE.

STATE.	U. S. CENSUS, 1900.	STATE CENSUS, 1905.	INCREASE FROM 1900–05.	DECREASE FROM 1900–95.	PER CENT. OF INCREASE.
Iowa	2,231,835	2,210,337	....	21,498	....
Kansas	1,470,495	1,543,818	73,323	...	5
Massachusetts	2,805,346	2,998,958	193,612	....	7
Michigan	2,420,982	2,530,016*	109,034	....	4
Minnesota	1,751,394	1,979,912	228,518	....	13
New Jersey	1,883,669	2,144,143	260,474	....	14
New York	7,268,894	8,066,672	797,778	....	11
North Dakota	319,146	437,070	117,924	....	37
Rhode Island	428,556	480,082	51,526	....	14
South Dakota	401,570	455,269	53,699	....	13
Wisconsin	2,069,042	2,228,949	159,907	....	8
Wyoming	92,531	101,816	9,285	....	10

* Figures for 1904.

These States, taken together, contained, in even thousands, 23,144 in 1900, and 25,177 in 1905. In 1900 they contained 30 per cent. of the population of the continental United States. The average rate of increase of all the States for the period was 9— per cent., the average rate per year being 1.7 per cent. The same States increased from 1890 to 1900 at an average annual rate of 1.95— per cent. The rate of increase has therefore been somewhat lowered—a result to have been expected. One State, Iowa, shows a slight decrease. All the others increased at rates ranging from 4 per cent. in the case of Michigan (for four years only) to 37 per cent in North Dakota.

The two most salient features of the foregoing table are the loss of population in Iowa and the great gain in North Dakota. Concerning Iowa, which has lost 1 per cent. in the last five years, although in the preceding five years (1895-1900) the State gained 8 per cent., a comparison by counties with the census of 1900 shows that losses were sustained by no fewer than seventy-eight out of ninety-nine counties, gains being recorded in only twenty-one. These twenty-one counties are widely scattered over the State. Certain of them are among the most populous, containing good-sized cities, to whose growth they owe their increase. Others are situated in the northwestern part of the State, and were sparsely populated in 1900. Still others owe their growth to railroad extension.

The cities and towns of Iowa have made good growth; it is in the rural districts that the State has sustained losses. While the State as a whole has lost 1 per cent. of its population, the rural population has diminished 5 per cent.; while all corporate places with a population of over 1,000 in 1905, taken collectively, have gained 9 per cent. Classifying the towns and cities and comparing the rate of growth of the different classes, it appears that the towns having a population between 1,000 and 10,000 increased 5 per cent., and that those between 10,000 and 100,000 increased at a much more rapid rate—*i. e.,* 14 per cent. In a general way, the larger the city the more rapidly it has increased. Of the third class, containing a population of over 100,000, this State has no representative.

This phenomenon which Iowa presents is not unusual, but is quite in accordance with the laws of population. It is almost purely an agricultural State. A little more than one-third of its inhabitants live in towns of 1,000 or more, and less than one-fifth live in towns of more than 5,000 population. The largest city has only 75,626 inhabitants, and there are but seven cities having between 25,000 and 50,000.

Taken as a whole, Iowa has reached the limit of agricultural density of population under present conditions. Her future growth will be due to manufactures and commerce, and until these are developed (their development being marked by the growth of her cities) she cannot make progress. She is now in the condition in which Ohio and Indiana were twenty years ago; and, like them, she will resume growth as her manufactures develop. Vermont reached that stage half a century ago, but has never been able to apply the cure and recover from it.

The four years' growth of Michigan, 1900 to 1904, shows a rate of only 4 per cent., the rural population having increased only 1.5 per cent and the cities 8 per cent., the latter containing a little more than half the people of the State. The rate of increase for the six years 1894 to 1900 was 8 per cent., showing a considerable diminution during the last four years.

The rates of increase in the three groups of cities were respectively 8 per cent., 8 per cent., and 11 per cent., the latter being the rate of Detroit.

Wisconsin has increased in population 8 per cent.—a rate much greater than Michigan, and greater than the increase between 1895 and 1900, which was 7 per cent. Since it lies west of Michigan, its settlement commenced later, and has not progressed as far. Its density of population is also less. Its rural element increased 6 per cent., and its cities of over 1,000 inhabitants, which, taken collectively, constitute 44 per cent. of the population, increased 10 per cent. The three groups of cities increased respectively at the rates of 9 per cent., 12 per cent., and 10 per cent., the last being the rate of increase in Milwaukee.

Minnesota, lying still farther west, increased at a still more rapid rate—13 per cent. Its rate of growth from 1900 to 1905 was even more rapid than in the preceding five-year period, which was 11 per cent. The rural element, which constitutes 55 per cent. of the entire population, increased 8 per cent. between 1900 and 1905, and the cities 20 per cent.

The increase in the three groups of cities was respectively 15 per cent., 14 per cent., and 26 per cent., the last being the rate in the twin cities—St. Paul and Minneapolis.

South Dakota increased at the same rate as Minnesota, 13 per cent., a rate much less than that of the preceding five years—namely, 21 per cent. The rural population, which comprised four-fifths of the total population in 1905, increased 10 per cent, and the urban element 27 per cent.

Of all the States taking censuses, North Dakota had the most rapid growth, its per cent. of increase in the five years being not less than 37. No State census was taken in 1895, so that a direct comparison with the preceding five-year period cannot be made;

but in the decade 1890 to 1900 the State gained 71 per cent., showing that it just about held its great rate of increase. The rural element, which comprises about five-sixths of the whole population, gained at the rate of 35 per cent, and the urban element 45 per cent.

Kansas, which from 1895 to 1900 gained 10 per cent. in population, made a gain of only 5 per cent. between 1900 and 1905. This gain was entirely in the cities, which formed a little more than one-third of the population. They increased at the rate of 25 per cent.; while the rural districts lost nearly 10,000 inhabitants, or at the rate of 1 per cent.

The cities having population between 1,000 and 10,000 gained 21 per cent.; while those over 10,000 inhabitants gained 29 per cent.

For a frontier State, Wyoming is having very slow growth. Between 1890 and 1900 it added only 31,826 to its population, or at the rate of 49 per cent. Between 1900 and 1905 only 9,285 inhabitants were added, being at the rate of 10 per cent. for the five years, showing an astonishing diminution in the rate of increase. The rural population, which comprised about 55 per cent. of the inhabitants, increased only 2 per cent., and the urban element 22 per cent.

New York increased in the five years at the rate of 11 per cent. As there was no State census in 1895, this can only be compared with the decennial increase from 1890 to 1900, which was 21 per cent., showing the rate to be maintained. Practically all of this increase was in the cities and towns, since the rural population increased only 0.6 per cent, while the towns and cities of over 1,000 inhabitants gained 14 per cent. Here, as in Iowa—and, indeed, in all the States here considered—the increase was least in the small places and largest in the great cities. Classifying the towns and cities by population, as was done for Iowa, it appears that those between 1,000 and 10,000 increased 9 per cent., those between 10,000 and 100,000 gained 14 per cent., and those of 100,000 and over 15 per cent. In this State nearly four-fifths of the inhabitants are urban.

New Jersey showed a good rate of growth, 14 per cent.—slightly greater than in the five years from 1895 to 1900, which was 13 per cent. This growth was mainly in the cities and towns, which contain more than three-fourths of the entire population. The urban growth was at the rate of 16 per cent., and the rural element 7 per cent. only.

The three groups of cities grew respectively at the rate of 18 per cent., 18 per cent., and 13 per cent. The last group consists of the three cities of Paterson, Newark, and Jersey City.

Massachusetts increased only 7 per cent. between 1900 and 1905, as compared with 12 per cent. in the preceding five-year period. In this State and in Rhode Island it is impossible to separate the urban and rural elements, since both may be present in each town, which is the smallest unit by which the population is given.

Rhode Island made the notable increase of 14 per cent., which may be compared with the increase in the preceding five years (1895 to 1900) of 11 per cent.

Taken collectively, the rural population of nine States, omitting Massachusetts and Rhode Island, shows an increase of only 3 per cent. The urban population, classified according to the size of the cities and towns, shows the following rates of increase:

1,000 to 10,000........	13 per cent.
10,000 to 100,000........	14 per cent.
100,000 and over	15 per cent.

The average rate of increase in the urban population is 14 per cent.

PRECISE LEVELS IN THE UNITED STATES.

In the past five years and since the adoption of an improved binocular precise level by the U. S. Coast and Geodetic Survey, and because of the vast amount of primary levelling now being run in accordance with the law by the U. S. Geological Survey, rapid strides have been made in the extension of precise levels over the United States. A few years ago we had in the United States lines of precise level by the Army Engineers up the Mississippi River to St. Louis, up the Hudson River, through the Great Lakes and down the Mississippi to St. Louis, and the transcontinental line of the Coast Survey from Sandy Hook to St. Louis.

Since the introduction of the new Coast Survey prismatic level, which has recently been adopted in the Geological Survey also, because of the rapidity and cheapness with which precise levelling of a high order can be run by this instrument, greater progress has been made in determining exact altitudes within the interior of the continent in the past few years than in all the preceding years.

The Coast Survey had, a year ago, extended its transcontinental line from Denver to Grainger, Wyo. It had run a line of precise levels along the 98th meridian from its transcontinental line southward to Fort Worth, where it connected with lines of the Army Engineers down the Red River to New Orleans.

Precise levels of the Coast Survey had been run from the neighbourhood of Mobile Bay *via* Chattanooga and Cincinnati to Toledo, where connection was made with the Army Engineers' levels in the Great Lakes. The Engineer Corps of the Army had run their routes of levels from the Mississippi up the Arkansas River to Fort Smith, and thence to Kansas City, connecting there with their levels up the Missouri River to Sioux City.

The Geological Survey had run precise levels from Newbern, N. C., *via* Knoxville and Atlanta to Brunswick, Ga., connecting at Chattanooga with the Coast Survey levels; also, through various portions of New York, Ohio, and especially along the Pacific Coast from San Francisco through the San Joaquin Valley to Los Angeles and through the Sacramento Valley to Portland; also from Seattle, eastward into Montana.

Last year the Coast Survey completed the extension of its precise levels from Grainger to Seattle. The result of this vast transcontinental chain from Sandy Hook, checked by numerous lines at St. Louis and farther out at Kansas City, Sioux City, and Denver, and reaching in a single line from Cheyenne to Seattle, gives a check between the two oceans of seven inches.

During the field season just closed the Coast Survey has extended its precise levels along the 98th meridian northward from Sioux City to the neighbourhood of Fargo, N. D., and is continuing the same down the Red River toward the Canadian boundary. The connection eastward from the neighbourhood of Fargo to the Army Engineers' levels at Duluth, on Lake Superior, is soon to be made.

The Geological Survey ran lines of precise levels during the past season crossing Iowa from near Council Bluffs to Des Moines; also, across Illinois from near Pekin, where connection was made with the Army Engineers' levels, to Champaign; in Ohio, from Chillicothe northward to Columbus; in Virginia and North Carolina, from near Raleigh northward to the Roanoke River; also from Greensboro northward to Roanoke, Va.

From the above it will be seen that elevations of precision, the heights of which will doubtless remain for many years, have been procured throughout nearly the whole eastern portion of the United States. In addition, primary levels of less accuracy, but still of comparatively high value, have been run throughout many portions of every State in connection with the topographic mapping of the U. S. Geological Survey. In connection with these primary levels, permanent bench-marks of metal have been set at distances averaging three miles apart wherever the levels have been run.

In the western part of the United States a large amount of precise levelling has also been done. In addition to the transcontinental line of the Coast Survey and the line of the Geological Survey from Oregon to southern California, spur lines have been run into northeastern Washington, northern Idaho, and Montana. In addition there are many disconnected lines of precise levels in Arizona, New Mexico and Montana, Utah, etc., which, it is expected, will be connected by extensions to be run within the next few years, thus reducing them accurately to mean sea-level.

In connection with some short lines of precise levels which were run the past season in southern California by the Geological Survey, some unlooked-for discrepancies were found between the elevations determined on the lines of precise levels run several years ago by the Geologic Survey from San Francisco Bay *via* Bakersfield, which is at the head of the San Joaquin Valley, to Los Angeles. The levels of the past season between Bakersfield and Caliente failed to check with a number of the bench-marks of the old precise levels by amounts of from eight inches to one foot. As both lines of level were of a high order, a number of these bench-marks were rechecked, with similar errors. The only possible way in which these peculiar discrepancies can be accounted for is on the assumption that the elevations of the region have been changed by an earthquake which occurred a few years ago.

The Geological Survey also ran a line of precise levels from Yuma, on the lower Colorado River, eastward about 200 miles to Tucson. In New Mexico a line of precise levels was run from Albuquerque northward up the Rio Puerco to the Colorado line, a distance of about 175 miles. Another line of precise levels is being extended southward from Albuquerque down the Rio Grande, a distance of about 300 miles to El Paso. A line of precise levels was also run from Harvey, on the Santa Fé Railway, northward to Owens Lake, and a check line from this was run westward to the summit of Mt. Whitney, in California. This line is now being extended eastward into Death Valley, California, and into the Amargosa desert, and its results are awaited with interest, as they will definitely determine its exact depth below sea-level. So far as indicated, the lowest point of this valley is 450 feet below sea-level, and is probably the lowest piece of dry land on the earth—that is, it is the lowest depression in which no water-body exists.

In Alaska material progress was made in the extension of detailed topographic mapping in connection with the studies of the economic mineral resources. The larger portion of the season's work was devoted to large-scale work, which will permit of more exhaustive investigation of the economic geology. The earlier reconnaissance scale of about four miles to the inch has been practically discontinued for surveys in Alaska, as the more important regions have now been covered by such surveys. A little of this work was done, and less of it will probably be executed in the future as the whole of the general physiography of Alaska is developed.

One topographic party, accompanied by a geologist, made a reconnaissance survey of an extensive area of country along the Beaver Dam River, the resulting maps being on the scale of four miles to one inch, with a contour interval of 200 feet. Another party mapped about 400 square miles at the mouth of Copper River, on the scale of one mile to one inch. Another party mapped quite an area about Solomon, on Seward Peninsula, on the scale of one mile to one inch.

One of the results of the season's work, covering as it does with those of previous years the mapping of a large portion of Alaska, has been a careful revision of the area of Alaska. This is now found to be about 586,000 square miles, or about 4,000 square miles less than has heretofore been accepted.

GEOGRAPHICAL RECORD.

AFRICA.

THE DUKE OF THE ABRUZZI GOING TO RUWENZORI.—The *Bollettino* of the Italian Geographical Society (March, 1906) says that the Duke of the Abruzzi, with an expedition, will leave Italy in April for the Ruwenzori range in Africa, which he hopes to explore. He will be accompanied by Captain Cagni, Dr. Cavalli, naval Lieutenant Winspeare, Vittorio Sella, the renowned Alpinist and photographer, Mr. Botta, and the guides Fenouillet and son and Ollier. The party will proceed to Mombasa, where a caravan of 250 native porters will be formed to accompany the expedition to the Ruwenzori range. The expedition will reach Victoria Nyanza by the Uganda Railroad, and from the lake will travel on foot to the mountains. Here the Italian members of the party will leave the natives, who are not familiar with mountain regions and could scarcely endure the cold of the upper altitudes. After ascending the range and completing their explorations the European members of the expedition will probably go north to Albert Nyanza and descend the Nile to the Mediterranean. It is expected that the work will require about six months.

MR. FRESHFIELD'S ATTEMPT TO ASCEND RUWENZORI.—Mr. Douglas Freshfield, accompanied by Mr. Mumm, went to the Ruwenzori range last fall to attempt the ascent of these snow mountains. November was unfortunately very unfavourable for mountain-climbing and exploration. Mr. Freshfield says in his paper on this journey (*Alpine Journal,* Feb., 1906) that he was told by whites and natives in the neighbourhood that January and July are the only fine-weather months on the mountains. His attempted ascent was made from the Mubuku Valley, which is the easiest, and perhaps the only, route from the east to the highest part of the range. Rain was almost incessant, and the climb of 8,000 or 9,000 feet to the head of the Mubuku Valley was through a succession of morasses, precipitous mud-slides, and barricades of fallen trees. The earlier explorers on this route were stopped by a rock-face calling for the use of a rope. Mr. Freshfield's party, however, soon mastered this obstacle; but above it they were compelled to take to the glacier, and, after step-cutting for about an hour, found themselves on the verge of the uncrevassed upper slopes which led to the gap south of the highest peak. From distant views and photographs obtained of this upper region, Mr. Freshfield feels confident that there would be little difficulty for practised climbers above this point. A height of 14,500 feet was attained, when dense fog descended, and after twenty-four hours without change in the weather, the party retreated to the lower valley.

Mr. Freshfield says the highest summit is not, as has been supposed, the bold rock peak conspicuous from the upper Mubuku Valley, but a snowy summit more to the north. He thinks the highest point of the range does not exceed 18,000 feet, and that the extent of the snowy range has been exaggerated. He believes a circle twelve miles in diameter would include all the glaciers. Trees grow up to an elevation of 15,000 feet. He found the mountain tribes, the Bakonjo, to be excellent porters. They carried heavy burdens up the worst paths with skill and alacrity, and were willing, helpful, and intelligent. They can climb rocks, but they have had no experience with snow and ice.

STUDIES IN THE WESTERN SAHARA.—The French, early last year, investigated a large area in the Sahara west of the Tuat oases to about 6° 50′ W. only 112 miles from Tenduf, a former important centre of the slave trade but abandoned since 1903. The *Renseignements Coloniaux,* published by the Comité de l'Afrique française (1905, Nos. X *bis* and XII *bis*), contain a detailed account of this journey, which was made by Captain Flye Sainte-Marie and a small party. The route led through Igidi, a region of extensive sand-dunes, which had been invaded by marauding bands from the southern borderlands of Morocco. The object of the expedition was to cross the principal caravan routes extending north and south and to study the present political and economic position of this part of the desert with a view to future operations.

It was found that six caravan routes from Morocco cross this region to the Sudan, all of them uniting at Taodeni, to the north of Timbuktu. Three of the roads start from the Tafilet oasis, two from the Wadi Draa, and one, which was Dr. Lenz's route across the Sahara, from Tenduf. Five of the routes pass through three districts of Igidi which have pasturage and other advantages and lie within a zone only 170 miles in width. The command of these three districts will virtually control the whole of the caravan trade in the western Sahara. There is now very little trade, and not a human being was met during the journey of 1,200 miles. But Captain Flye Sainte-Marie believes that as soon as Igidi is protected from Moroccan robber bands these trade routes will again be utilized.

COLONISTS IN GERMAN EAST AFRICA.—*Der Tropenpflanzer* (March, 1906) prints a long circular issued by the Government of German East Africa, containing detailed information for the use of white colonists who desire to settle in the Kilimanjaro province. The Government says that colonists will enter this undeveloped field upon their own responsibility, and must expect to face privations common to pioneer life in new countries. But nature there is fairly bounteous, and although the prospect of acquiring large means is very slight, the diligent man may make a home for himself and become independent. The colonist should have a capital of at least $2,000, and married men are most desired. Most of the province consists of grassy steppe, with large and small areas of forest in the north near the mountains. The native population at the foot of Kilimanjaro is so large that European settlers can acquire very little acreage among them. The soil is generally fertile, but the settler should take only such land as has perennial running water. Allotments of land may be secured by lease at a cost of only a few cents per acre. As soon as the settler has one-tenth of his holding under cultivation or otherwise usefully employed, he will be entitled to purchase twice as much land as he has improved at one to two rupees a hectare. The circular intimates that good labour may be obtained among the natives, who, if well treated, will work faithfully for three rupees (75 cents) a month. The chief industries must be general agriculture and stock-raising. All the information needed by immigrants is found in the circular. This region is only about 200 miles south of the Equator, but its high elevation mitigates the tropical heat.

One of the High Plateaux of British East Africa.—Major A. St. Hill Gibbons recently read a paper before the Royal Geographical Society (*The Geog. Jour.*, March, 1906) on his study of the Guas Ngishu plateau in East Africa, in the early part of 1905, with a view to ascertaining its adaptability for European agricultural settlement. The information he and his colleague, Mr. Kaiser, obtained makes an important addition to our knowledge of this plateau, most of which stands 6,000 feet above sea-level. This is the western part of the high plateau region of British East Africa. He found nothing in the temperature of the Guas Ngishu to prejudice its colonization prospects. He believes that this, as well as other higher altitudes of this part of Africa, will be numbered among the admittedly healthy countries of the world, and that they will have considerable agricultural development. He found that the streams on the plateau flow so rapidly as to deprive the mosquito of his natural breeding conditions. There is almost total absence, also, of the rank river vegetation which this insect loves so well. The natural health conditions are excellent, and the disease-bearing mosquito and flies are absent. The soil in the valleys and lower-lying lands is excellent for agricultural purposes, but the country seems to be best fitted for cattle-raising and forest products. The plateau can support as many cattle as any similar area in Africa.

Professor Koch on the Sleeping Sickness.—Professor Koch is about to start on a second expedition to the northern coast of Victoria Nyanza for the purpose of making further studies of the *glossina palpalis,* the fly by which the infection of the sleeping sickness is conveyed to human beings, and of the possibility of prophylactic measures against the infection. He found on his first visit that the fly is on all the coasts of the Victoria Nyanza, although the sleeping sickness is chiefly confined to the northern coast.

AMERICA.

Physiography of the Taconic Mountains.—In a recent *Bulletin* of the United States Geological Survey (No. 272, 1905), Professor T. Nelson Dale presents a rather full description and discussion of the physiography of a part of the Taconic Mountains in Western Massachusetts and Southern Vermont, illustrated by a number of excellent half-tones and sections from topographic maps. The history of the region is briefly as follows: First there was an accumulation in a broad arm of the ocean of a series of sediments which, together with a crystalline basement, were later thrown into a series of parallel folds, diminishing in altitude from east to west. There were three periods of folding: one at the close of the lower Cambrian; the second, more extensive, at the close of the Ordovician; and the third either in Devonian or Carboniferous time. Both faulting and metamorphism accompanied this folding. A long period of denudation reduced the series to great longitudinal ridges and valleys, and in some places stripped off the sediments, revealing the crystalline rocks of the ancient sea-floor. The last phase in the modification of the topography was that caused by the glacial invasion.

The effect of denudation on this mountain complex has been to introduce three prominent topographic types. The first of these, called the plateau type, includes the Green Mountain range, with its gently-undulating or roundish surfaces with few and usually not rugged elevations, but with its flank deeply incised. The Rensselaer plateau, a small westerly-inclined peneplain, is also classed with the plateau type.

The second type, called the Taconic, consists of alternating ridges and valleys, the ridges being cut by transverse and diagonal valleys, and sometimes intricately dissected.

The third type, the Hudson-Champlain, is less marked in character, consisting of minor, irregular elevations and depressions, but with a series of isolated hills reaching to nearly 700 feet above the general surface.

The plateau type is the result of the toughness of the crystalline rock, in which the effect of structure is of minor importance, the whole mass offering essentially uniform resistance to erosion. The ridge and valley (Taconic) type reflects the influence of variable degrees of resistance in the underlying rocks. This difference in rock structure also affects the vegetation, for the limestone of the valleys, even when covered with drift, possesses a more fertile soil than the schist areas. The latter, moreover, since they constitute the hill tops, are more rugged, bear less drift, and are prevailingly forest-covered, while the limestone valleys are more commonly cleared and tilled. R. S. T.

MARYLAND'S MAGNETIC SURVEY.—Volume V of the Maryland Geological Survey (1905) contains the second Report by Dr. L. A. Bauer on magnetic work in Maryland, summarizing all the results obtained thus far. The general field work has now been brought to a close. The operations hereafter will consist, on the part of the Coast and Geodetic Survey, in the reoccupying of certain stations known as "repeat stations," for the purpose of ascertaining the amount of annual change of the magnetic elements. With the aid of these results the magnetic maps of Maryland can always be brought up to date. The future work on the part of the State will consist in the delineation of the disturbed areas and the correlation of the magnetic disturbances with the geological formations. Dr. Bauer says that Maryland now possesses the most detailed magnetic survey of any country, with the exception of Holland. The magnetic survey of that kingdom embraces, on an average, one station to every forty square miles; that of Maryland, one to every 100 square miles; that of England, one to 139 square miles; and that of Missouri, one to every 438 square miles. In this list New

Jersey is not given, since only declinations were observed. The Report abounds with tabular statements of the results of the magnetic work to date. Maps of lines of equal declination, inclination, and horizontal intensity for Maryland, Delaware, and the District of Columbia are presented.

GROWTH OF SAND REEFS ALONG THE NORTH CAROLINA COAST.—Prof. Collier Cobb, of the University of North Carolina, has reprinted from the *Journal* of the Mitchell Society (Vol. XXII, No. 1) the "Notes on the Geology of Currituck Banks" which he wrote in the summer of 1904, when he made a careful examination of these banks from the Virginia line to Kittyhawk Bay and the Kill Devil Hills. The sand-reefs or banks along the North Carolina coast have grown steadily in length from the time of the earliest settlements, until there is now no inlet from Cape Henry to Oregon Inlet. The inlets through the Currituck Banks have been closed up by the steady southward march of the great barchanes or *médanos,* crescentic sand-dunes, known locally as whaleheads. These dunes are composed of singularly homogeneous blown sands, the horns or cusps of the barchanes pointing to leeward, which is almost due south:

> Following the ocean side of Currituck Banks, one may often see a distinct terrace marking the line between the Columbia sands and the Neocene clays; on stormy days comminuted Tertiary shells are washed up, and quite frequently after a storm one may pick up water-worn shells of *Cardium*, *Anomia*, and *Exogyra*, of which I brought away a score of specimens. These are distinctly Cretaceous forms. The facts go to show that the Banks are not of such recent origin as is usually supposed, but are of the same age geologically as the adjacent mainland.
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> On the Atlantic side of this Currituck Bank I found numerous pebbles, some as much as three to four inches in diameter, buried in the upper sands and muds, some well rounded, others sub-angular, and some of these latter even striated. These pebbles are, almost without exception, unlike any of the stone of the mainland of North Carolina; and both their position and individual characters point to their glacial origin. It is clear that they are the work of the ice-sheet of the last glacial period, drifted southward by icebergs which stranded on the Carolina coast.
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> A rather rapid subsidence of the coast is now in progress; the blown sands and the silt, arrested by aquatic vegetation, are rapidly filling in the sound side of the Banks, and the water of the Currituck Sound has already become fresh since it has been cut off from direct communication with the sea, the inflowing streams having leached out the salt.
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> The Great Whaleshead barchane opposite Church's Island has moved southward three-quarters of a mile in twenty years, and the closing up of the sound has been so rapid as to bring about litigation in the courts for the possession of the new-made land. The subsidence of the land is so easily seen from beacons and telegraph poles as to be a matter of remark among the least observant of the inhabitants.

IMPROVING ROADS IN INDIANA.—State Geologist Blatchley, of Indiana, informs us that, during the past year, several of his assistants have continued the investigation of the road materials of Indiana. This work has been in progress for two or three years, and will form the main feature of the report for 1905. Every county in the State has been visited, and a study made of the available materials for improving roads. These are of two general classes—gravels and limestones. The gravels are much more widely distributed, and, in general, more available than the limestones. They are for the most part drift gravels, though many of them have been assorted and redeposited a number of times by streams.

In the southern third of the State are numerous deposits of gravel derived from the decay of the country rock. Those from the Knobstone or Waverly formation are mostly of iron carbonate, and roads constructed from them have proved very durable and smooth. The same is true of the gravels from the Harrodsburgh (Keokuk) limestone, which are largely composed of geodes and other fragments.

Six or seven different limestones are available in the southern half of the State for macadam purposes. In the northern half these are almost everywhere too deeply covered with drift. About sixty samples of limestone from various parts of the State have been sent to the U. S. Testing Laboratory at Washington, and the results of the tests will be incorporated in the report.

THE COURSE OF THE TENNESSEE RIVER.—The remarkable course of the Tennessee River, which leaves the broad, open Appalachian valley of Tennessee to cross the Walden Ridge near Chattanooga, has attracted the attention of physiographers, and has been the subject of several articles. Hayes and Campbell have proposed as explanation of the peculiar river course that the Tennessee was diverted from the old Appalachian valley by headwater capture and led across the Walden Ridge. Recently C. H. White (*Jour. Geol.*, Vol. XII, 1904, pp. 34-39) has stated objections to this theory, and D. W. Johnson, more recently still (*Jour. Geol.*, Vol. XIII, 1905, pp. 194-231), has brought forward facts which are opposed to it. Among the points made by Johnson are the following: The gorge across the Walden Ridge is winding, and its course is more in harmony with the theory of inherited meanders of a former period of base-levelling than with headwater capture. The Walden Ridge is breached in only this one place, whereas if headwater erosion had been in progress sufficiently to divert the Tennessee it would be expected that other small streams would have eaten backward far into the ridge. The divide south of Chattanooga has a form quite out of harmony with the theory of a former course of a large river across it. The stream which is supposed to have captured the Tennessee was tributary to a smaller stream than the Tennessee, and therefore, on the theory of capture, it must be supposed that a small river was able to capture a much larger one, which does not seem probable. The presence of gravels along the Tennessee and their absence in the Appalachian valley to the south is also opposed to the theory of Hayes and Campbell. Altogether, Johnson makes out a strong case in favour of the alternate theory, which White previously supported, that the course of the Tennessee is simply inherited from that of a former lowland state, and is not the result of river capture. R. S. T.

PROTECTING RUINS IN THE SOUTHWEST.—A bill is now before Congress the aim of which is to preserve the historic and prehistoric ruins of Arizona, New Mexico, Colorado, and Utah. Two years ago, Mr. Edgar L. Hewett wrote a report* on these ruins and their preservation in which he dealt at length with their distribution. He showed that the habitat of the prehistoric tribes of the southwest had been determined by the drainage systems, the great basins of the Rio Grande, the San Juan, the Little Colorado, and the Gila constituting the four seats of prehistoric culture of the so-called pueblo region. The remains of this ancient culture are of the three types—pueblo ruins, cliff houses, and cave dwellings. His map showed the most important ruins in the pueblo region. The information collated by Mr. Hewett is the basis of the proposed law for the preservation of the remains. It is well known that in recent years an extensive traffic has arisen in relics from these ruins, and, in securing relics, buildings, mounds, and other objects have been destroyed. These relics are priceless when secured by proper scientific methods, but of comparatively little value when scattered about in museums or private collections without accompanying records.

CORRECTION.—Dr. E. O. Hovey writes on the 29th of March:

> In lines 4 and 5 of "Geographical Notes on the Western Sierra Madre of Chihuahua, Mexico," page 84 of BULLETIN, Vol. 38, No. 2, *south* should read *north* and *north* should read *south*. This error must have been in the copy, but I cannot understand how I failed to see it.

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* Circular relating to Historic and Prehistoric Ruins of the Southwest and their Preservation. General Land Office, Washington, 1904.

ASIA.

AMERICAN TRAVELLERS IN CENTRAL ASIA.—Prof. W. M. Davis sends us the following extracts from letters lately received from two of his former students, now exploring the desert regions of Central Asia. The first part of their journey was made together. In the later months they have been travelling independently:

FROM MR. BARRETT.

DALAI KOURGAN, NEAR
KARA MUREN RIVER, CHINESE TURKESTAN, Dec. 16, 1905.

Our regular work began when we left Srinagar last spring, travelling by the trade route to Leh. From there we crossed the Chang La (pass) and went up the Shyok to the main route over the Karakoram, which we followed nearly to Suzet Pass. Here we diverged somewhat to the east, and crossed an easier pass by the smaller trail which led down to the Karakash. We then tried the Hindu tash pass to the north, but, failing there because of the very deep snow, descended the Karakash to the main trade route. We crossed the Sand-ju pass and descended a river and entered a district of the same name. We examined a number of valleys on our further way to Khotan. From there we went on to Nura by an easy trail between the Karakash and the Yurungkash. We examined the country very critically from Nura to the Kara-tash and from the head to the mouth of that river. Here Huntington and I parted company, and I went on by the trade route to Kiriya. Later I returned to the Kara-tash and did more work there and in a neighboring valley. After a second visit to Kiriya, I went to the ruined villages that Stein had seen, and thence eastward to Moldja and to my present stopping place.

From here I am planning to go eastward, with various side trips, and later on shall reach Lan Tchou, in the province of Kan-Su, by the southern trade route. . . . R. L. BARRETT.

FROM MR. HUNTINGTON.

CHERCHEN, CHINESE TURKESTAN,
Nov. 27, 1906.

. . . We are going to rest in this village of a thousand inhabitants for about a week. I am comfortably lodged in a cavernous chamber lighted by an eighteen inch hole in the roof and heated by a mud fireplace six inches wide and three feet high. It is really very comfortable here, compared with the fire in the sand, by which I slept a few nights ago, when I failed to find the caravan on returning from a trip along a belt of dying-out jungle, where I had ventured too far. The days are still bright and warm, 50° to 60° F.; the nights are cold, from 15° to 25°. Great preparations are in progress here for the feast of Bairam at the end of a month of fasting. . . .

The six weeks since I last wrote have been the very best of the whole journey. The evidence of old towns and of areas of dead vegetation seems to prove almost conclusively that there has been a steady desiccation of the Tarim basin throughout historical times. Evidence is also accumulating regarding the relation of the river courses, especially where they change from centripetal to peripheral courses, to the former shore lines of Lop Nor. . . . My men are a fine lot. They are as keen as I am in looking for old cities or rivers. Now one and now another comes with some story of a ruin which he has learned from the natives. I have five men, five camels, and eight horses; that may seem large, but I think it is the smallest caravan with which any explorer has ever come into this region. A good-sized caravan is a necessity, for one must be able not only to carry supplies for two or three months, but to run the caravan in two independent sections. During the last forty days the only people we have seen were a few shepherds. Most of this time I have been away from the main party, usually with two men and three camels, besides a local guide, looking for the ends of rivers far out in the sands. . . .

ELLSWORTH HUNTINGTON.

TOPOGRAPHY AND RAINFALL IN INDIA.—In a paper on "Some Geographical Peculiarities of the Indian Peninsula" (*Scot. Geogr. Mag.*, 1905, p. 459) the author, Cameron Morrison, points out that the position of the Western Ghats so near the windward coast of India has deprived the interior of much of the rainfall that would otherwise come to it. Most of the rainfall (over 100 inches in the year, on an average) flows down the western slopes into the sea, and is practically lost to agriculture except on a narrow strip along the coast. An interesting case of man's interference with nature in such matters is the successful attempt of the Madras Government to divert water from the western to the eastern slopes of the Western Ghats. At great expense one of the west-flowing streams has been dammed, and, by means of a tunnel cut back through the hills to the east, the waters are led over to the eastern slopes of the mountains, and serve to irrigate a large tract on their leeward side. Thus, by man's skill, the heavy rainfall on the windward side becomes available on the leeward side, where the presence of the mountains has produced a deficient precipitation.

R. DEC. W.

THE PRESSURE AND RAINFALL CONDITIONS OF THE TRADES-MONSOON AREA.—In 1900, Mr. W. L. Dallas, of the Meteorological Department of India, discussed the seven monsoon seasons of 1893 to 1899. He showed that (1) the monsoon rainfall was deficient during the rising portions of a series of oscillations of pressure which occurred during these seven years, and in excess during the falling portions, the amount of rainfall variation agreeing directly with the rapidity of the pressure changes, and (2) that the pressure oscillations showed a periodicity of about four years. Lately, Mr. Dallas has carried his discussion further, in order to determine over what area the pressure oscillations extended, how they agreed in amplitude and in time throughout the affected area, and what relation the rainfall of the whole monsoon area bore to the pressure oscillations. The conclusions tentatively reached are as follows: (1) Four-year oscillations of pressure occur over the trades-monsoon area, most markedly over the equatorial belt. (2) During the rising portions of these oscillations the general rainfall of the trades-monsoon area is below, and during the falling portions is above, the average. There is a well-marked minimum of rainfall in the first year of the cycle, and a well-marked maximum in the third year. (3) At irregular intervals rays or streamers of varying extent and intensity emanate from the Antarctic or extreme southern regions, and these cause increased pressure over the affected area. (4) The rays or streamers affect large areas practically simultaneously, continue for considerable periods, and are apparently not in the least of the nature of waves. (5) When extensive, as in 1899 and 1900, the pressure is above normal, and exhibits large oscillations. When absent, as in parts of 1898-1899, the pressure is low and the oscillations are small. (6) These variations are superposed on the four-year cycle above mentioned, and are spasmodic, producing irregular variations of rainfall and irregularities in the pressure cycles. Satisfactory explanation of the four-year pressure cycle and of these irregular pressure disturbances has not been found as yet. The variations of pressure cannot be the result of variations of rainfall, for these variations are as marked in a dry as in a wet area, and the variations in pressure precede the variations of rainfall.—(*Proc. Amer. Philos. Soc., XLIV*, 1905.)

The interest which attaches to any such study of periodicity is peculiarly great in a region like India, where so much depends upon the time of occurrence, the distribution, and the amount of the monsoon rains. In India, as is well known, long-range forecasts, based upon thoroughly sound scientific principles, are regularly made in the case of the monsoon rains. Any light which can be thrown upon the controls of these rains will be of benefit to millions of people in that populous country, for the Indian meteorologists will at once use this knowledge in making their seasonal forecasts. R. DEC. W.

CLIMATE AND HEALTH IN THE PHILIPPINES.—A valuable investigation of the mortality statistics for the Philippine Islands, by Henry Gannett, occupies the greater part of Vol. III of the *Census of the Philippine Islands*, taken under the direction of the Philippine Commission in 1903 (Washington, 1905). With the increasing interest on the part of Americans in tropical hygiene, more and more attention will be paid to the study of the diseases of our tropical possessions and of their relation to weather and climate. The normal death-rate is given as 31.7, which is 82% greater than that of the United States (17.4 per thousand). It must be remembered, however, whenever tropical death-rates are under discussion, that the lack of proper sanitary precautions among tropical natives is usually sufficient cause for a much higher rate than that found in highly-civilized countries, where so much attention is paid to hygiene. Many other controls also affect the Philippine death-rate, as, for example, in the year 1902, when it was 63.3 per thousand, or just about double the normal. This excess, we are informed, was largely due to the prevalence of cholera, but other factors to be considered were the loss of crops through locusts, the loss of carabao, and the after-effects of the insurrection, which resulted in lowering the vitality of the natives through hardship, exposure, and want of food. At one time, when the United States first obtained control of the Philippines, it was officially stated, in a Government publication, that the death-rate among the American troops in the Philippines was no larger than the death-rate in an ordinary American city. The inevitable result of such a statement was the conclusion, on the part of our public, that residence in the Philippines, so far as general climatic conditions are concerned, was not attended by any higher death-rate than life in one of our cities. It was not apparent to the general public that it is absolutely illogical to draw any such conclusion from a comparison between the death-rate of American men, in the prime of life, selected for service in the Philippines, and many of them invalided home before they died, with the death-rate in an American city, based on the returns of deaths of all ages, of both sexes, and from all causes. It is, therefore, with especial care that the statement on pages 26-27 of this volume should be read:

> The death-rate of whites was 32 per thousand (1902). This, though only one-half of the death-rate of the brown people, must still be regarded as large, inasmuch as the white people in the islands are almost entirely adults in the prime of life; that is, in the class which commonly has the minimum death-rate. In the United States the death-rate of this class is much less than the above figure; and while probably the death-rate of the whites under Philippine conditions is greater than in their native country, it can scarcely be increased to this extent, especially since the sick are usually removed to the States or to Japan, if possible.

From a meteorological point of view, a series of diagrams showing the proportion of deaths from the various diseases by months is of especial interest. In 1902 the smallest number of deaths in any month was in February, from which time the number increased rapidly up to September, and then decreased. The smallest proportion of deaths occurred in the cool season (24.5%); 28.4% occurred in the warm season, and 47.1% in the wet season. As is the general rule, for the tropics as a whole, malaria, dysentery, and diarrhœal diseases cause a large proportion of all deaths. In the United States, on the other hand, deaths from the well-known "Temperate Zone" diseases—pneumonia, heart disease, and typhoid fever—are much more common than in the Philippines. Tuberculosis was the fourth disease in fatality in the Philippines in 1902. In the United States it is commonly the most fatal of all diseases. In the year 1902, deaths from cholera were at a maximum in September; from beri-beri in the wet season (August to October); from diseases of the stomach in the warm and wet seasons (April to September); from smallpox, in March, April and May (warm season). Tuberculosis showed little relation to weather. Bronchitis is least common in the cool season. Dysentery shows a distinct maximum in July, August, and September. More than half the deaths from this disease occurred in the wet season. From diarrhœa the deaths in the wet season were two-thirds greater than in the warm season, and two and a half times as great as in the cool season. It is a rather striking fact that the number of deaths from malaria was about the same during the cool months as during the warm months. R. DeC. W.

EUROPE.

The New Map of France on a Scale of 1:50,000.—The Commission centrale des travaux géographiques voted in 1898 to produce a new map of France on a scale of 1:50,000, or 0.7 statute mile to an inch, in colours, to be based upon resurveys on a scale of 1:10,000 and 1:20,000. It was decided that these surveys should not be reserved for the exclusive use of the army, but should be made also for the purpose of meeting the needs of science and industry. The topographic resurvey was begun in 1903. The Geographical Service now has the topographic surveys required for the publication of thirty-two sheets of the map on the scale of 1:50,000. Nine of these sheets, representing Paris and its environment, have been presented to the Chamber of Deputies, in the hope that the utility of the work will be appreciated and the necessary credit for carrying it out voted.—(Condensed from the *Bulletin de la Société de Topographie de France,* Dec., 1905.)

Shortening the Route between St. Petersburg and the Siberian Rail Road.—The new railroad between St. Petersburg and Vologda has been completed. The line from Vologda to Viatka is now building, and the construction of the direct line from Perm to Cheliabinsk has begun. These roads will make a shorter route between St. Petersburg and the Siberian railroad at Cheliabinsk, and will stimulate the export of Siberian grain by way of St. Petersburg. According to the *Board of Trade Journal,* the distance bettween St. Petersburg and Cheliabinsk will be 226 miles shorter than by the present route *via* Moscow. It will mean twelve hours saved for passenger traffic and over twenty-four hours for freight and a cheapening of freight rates of from 17 to 7 kopecks per pood. The shorter route will somewhat change the conditions of the Siberian export trade, and butter and game are likely to be despatched to St. Petersburg and Reval instead of, as now, to Riga and Libau.

POLAR.

Mr. Wellman's Arctic Polar Project.—Mr. Godard, of Paris, is building an airship for Mr. Walter Wellman, in which he will try to reach the North Pole. The expenses will be paid by the Chicago *Record-Herald,* of which Mr. Wellman is the Washington correspondent. The airship, which will be 164 feet long, 53 feet in its greatest diameter, and with a lifting power of 16,000 pounds, will carry five men, food for them for seventy-five days, motor boats, sledges, tools, etc., and 5,500 pounds of gasoline for the motors. The balloon will consist of three thicknesses of fabrics with three coatings of rubber, and, according to experts, it will approximate closely to gas tightness, though no means have as yet been found of making with fabrics an absolutely gas-tight reservoir. The outer rubber coating will be perfectly smooth, with nothing to hold moisture, snow, or frost. The motive power, composed of two motors driving two screws, will give speed of twelve to nineteen statute miles an hour. The men will have a comfortable car to live in. Mr. Wellman hopes to ascend from an easily-reached base of operation in northern Spitzbergen, the point of departure being only 550 geographical miles from the Pole. He will leave Norway for Spitzbergen in June, and expects to start on his air journey in August.

VARIOUS.

GLACIAL EROSION.—Those who still question the efficiency of ice as an important agent of erosion will gain small comfort from reading Prof. Davis' last contribution to that subject (*Scottish Geographical Magazine,* Vol. XXI, 1906, pp. 76-89), originally read before the Cape Town meeting of the British Association. His paper is a general discussion of glacial erosion, and so clear and convincing that it is difficult to believe that it can be carefully read without carrying conviction with it. The paper does not admit of an abstract; it must be read as a whole. And surely the great majority of readers must agree with the concluding sentence, that "The sculpture of mountains by glaciers is indeed now proved by so many facts, widely and yet systematically distributed, that it savours of extreme conservatism any longer to deny the efficacy of glacial erosion." R. S. T.

GEOGRAPHICAL CYCLE IN AN ARID CLIMATE.—The cycle of normal development of a river valley, for the full statement of which geographers are indebted to Prof. Davis, has been of immense value to the progress of scientific geography. In a recent number of the *Journal of Geology* (Vol. XIII, 1905, pp. 381-407), Prof. Davis has shown, by the deductive method, what the probable development of land-forms in an arid climate would be throughout a complete geographical cycle, and wherein it would depart from the cycle in a humid climate. In his paper he clearly shows how, in a region of interior drainage, the combination of stream erosion, deposit of waste, and wind action will cause the gradual reduction of the land-surface to a plain of high level, which he calls levelling without base-levelling. This result, first stated by Passarge in his description of the Kalahari Desert (Die Kalahari, Berlin, 1904), Prof. Davis calls Passarge's Law. Doubtless, owing mainly to the fact that arid regions have not been studied by geographers with the normal cycle of development of arid land-forms in mind, it is not now possible to cite illustrations of the many steps in this development; but the final stage of levelling, the arid land old age, seems to be clearly illustrated in the Kalahari region, where an extensive upland plain truncates a series of very diverse rocks, with only minor undulations where especially-resistant areas stand up above the general level as monadnocks. Prof. Davis adds that, in view of Passarge's Law, it is necessary to reconsider some of the cases of high-level peneplains, which may have been produced in an arid climate without the necessity of the theory of base-levelling and subsequent uplift; and he points out that this is necessary even in regions of present humidity, since, by climatic changes, humid regions of the present may formerly have been arid. This paper by Prof. Davis is an important contribution to physiographic literature. R. S. T.

WATER-VAPOUR AND NOCTURNAL RADIATION.—J. R. Sutton, meteorologist of the De Beers Consolidated Mines, Kimberley, South Africa, some years ago made a study of the relation between the minimum temperature at Kimberley and the absolute and relative humidities. A comparison was made between the fall of temperature between 8 P.M. and the succeeding minimum on every clear night throughout one year on the one hand, and the absolute and relative humidity at 8 P.M. on the other. The conclusion was that no certain connection could be traced between the dew-point at 8 P.M. and the fall of temperature, but there did not appear to be a uniform increase of range of temperature with a decreased relative humidity (J. R. Sutton: "Aqueous Vapor and Temperature," Symons's Met. Mag., Aug., 1895). During the past few years Mr. Sutton has been investigating this matter further, using as a standard the fall of temperature in one hour corresponding to the relative and absolute humidity at the beginning of the hour. It appears from his tables that the absolute and relative humidities are quite independent of each other in this inquiry; that there is no decided relationship between either element and the wind velocity, and that the relative humidity is the only element which shows a relation to the fall of temperature.—("The Influence of Water Vapour upon Nocturnal Radiation," *Sci. Proc. Roy. Dubl. Soc.*, XI, N. S., Aug., 1905.) R. DeC. W.

SYNCHRONOUS VARIATIONS IN SOLAR AND TERRESTRIAL PHENOMENA.—Under the foregoing title, H. W. Clough has recently (*Astrophys. Journ.*, XXII, 1905, 42-75) published the results of a somewhat extended investigation made by him, chiefly along the lines laid down by Brückner in his well-known work, *Klimaschwankungen seit 1700*, in which the evidence in favour of a cycle of about thirty-five years in certain climatic elements, such as temperature, rainfall, pressure, and so on, is very fully presented. An examination of the 36-year cycle in solar phenomena leads to the conclusion "that periods of maximum solar activity, characterized by a minimum length of the 11-year cycle, are followed 7 to 10 years later by terrestrial temperature minima, and 6 years thereafter by rainfall maxima; and that, coincidently with the low temperature, the activity of the general circulation reaches a maximum, and storm centres move with increased velocity and in lower latitudes." Further study of the 3½-year cycle in solar activity shows that the conditions which prevail at or shortly after the secondary maxima of solar activity in this cycle are identical with the conditions which exist in connection with the solar maxima in the 36-year cycle. The results are therefore mutually confirmatory. Increase in solar activity, both in short and long periods, produces an increased activity of the circumpolar whirls, forcing masses of cold air equatorward, and causing both low and high pressure areas to move in lower latitudes and with increased velocity. Again, variations in solar activity in a 300-year cycle seem to be associated with variations in the length of the 36-year cycle, ranging from 30 to 45 years, and there are similar variations in the length of the 11-year cycle. Thus there appears to be a close connection between variations in solar and terrestrial phenomena in 300-year, 36-year and 3½-year cycles. R. DeC. W.

THE MAGNETIC SURVEY OF THE PACIFIC OCEAN.—We learn from Dr. L. A. Bauer that the yacht *Galilee*, which is engaged in the magnetic survey of the Pacific Ocean under the auspices of the Carnegie Institution, Washington, left San Diego on March 2d to begin her second cruise. It will be recalled that her first cruise last fall was from San Diego around the Hawaiian Islands and back to San Francisco. On her present journey she is expected to make about 20,000 miles by the end of the year, visiting the waters of Fanning Island, Samoa, Fiji, the Marshall Islands and Guam, Yokohama, the Aleutian islands and back to San Diego. Several members of the former staff were obliged to return to their official duties, and the command of the vessel was accordingly entrusted to Mr. W. J. Peters, formerly of the astronomical and topographical corps of the

U. S. Geological Survey. Mr. Peters, while with the second Ziegler Polar Expedition, made a valuable series of magnetic, meteorological, and tidal observations at Teplitz Bay, Franz Josef Land. The other members of the staff are Messrs. J. C. Pearson, formerly Instructor of Physics in Bowdoin College, and J. P. Ault, magnetic observers, and Dr. H. E. Martyn, surgeon and recorder. Sufficient funds have been allotted to permit carrying on the work throughout the year.

According to a dispatch received early in April, the *Galilee* arrived safely at Fanning Island on March 31, having accomplished the trip of 3,500 miles from San Diego in 29 days, besides executing successfully magnetic work along the entire cruise.

NOTES.—THE PARIS GEOGRAPHICAL SOCIETY has awarded one of its gold medals to Major C. H. D. Ryder for his work as surveyor and explorer and his expedition to the sources of the Brahmaputra, in connection with the recent Tibet Mission.

THE CARNEGIE INSTITUTION is said to have purchased a tract of six acres in the northwest section of Washington, where it will erect a permanent home. The site is near the building of the United States Bureau of Standards, and overlooks the entire city. The price paid was $35,000 an acre, and a building to cost $100,000 will be erected at once.

A. HARTLEBEN'S Statistische Tabelle for all countries has appeared for 1906, with the latest official information as to the density of population, state finances, commerce, communication, weights and measures, army and navy, large cities, etc. All these facts are tabulated on one sheet, 39 by 28 inches in size. The "Kleines Statistisches Taschenbuch," by the same firm, gives all this information in a neat little volume of 104 pp. that may be slipped into a side pocket, and is sold for M. 1.40.

PROFESSOR C. W. HALL, of the University of Minnesota, is writing a geographical guide to the towns and cities of the State. It will be published during the year by the Geographical Society of Minnesota, which held its second annual meeting at the State University of Minneapolis on Dec. 26 last. In the past year the Society had four field days.

PROF. HEINRICH RIES, whose book on the "Economic Geology of the United States" has recently appeared, completed last year a report on the clay industries of Wisconsin, which was recently sent to press by the Geological and Natural History Survey of that State.

DR. A. J. HERBERTSON, Reader in Geography at Oxford, has been appointed by King Edward as the scientific member of the Royal Commission which has just been chosen to inquire into the condition of the canals and other inland navigation of the United Kingdom.

AMERICAN GEOGRAPHICAL SOCIETY—TRANSACTIONS, MARCH, 1906.—A Regular Meeting of the Society was held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, March 20, 1906, at 8.30 o'clock, P.M.

Vice-President Moore in the chair. The following persons, recommended by the Council, were elected Fellows:

C. G. Rothschild.
Lewis A. Platt.
Carl C. Shippee.
Edmund H. Sears, 2nd.
Charles Henry Davis.
Anna Eaton Collins.
George Gilbert Entz.
Jesse R. Grant.

Edward G. Peters.
Edwin S. Townsend.
James J. Sheppard.
Murray M. Shoemaker.
Dwight A. Jones.
Paul J. Sachs.
Frederick G. Morgan.
Arthur W. Stevens.
Arthur Edward Spohn.
Edward A. Sumner.
Rush Sturges.
Henry N. Sweet.
Charles Hamot Strong.
Walter W. Shaw.
William M. Chadbourne.

The Chairman then introduced Prof. Albert Perry Brigham, who addressed the Society on the Fiords of Norway. Stereopticon views were shown.

On motion, the Society adjourned.

EXHIBITION OF MOUNTAIN VIEWS.—The collection of Signor Sella's photographs of the Alps, the Caucasus, the Himalayas, the Saint Elias range, and Mount Etna, lent to the Society by the Appalachian Club of Boston, was opened to the Fellows and the public in the Society's house, 15 West Eighty-first Street, for the four weeks ending March 14.

NEW MAPS.

AFRICA.

BRITISH EAST AFRICA.—Map of East Africa Protectorate. Scale, 54 statute miles to an inch. Prepared by the Public Works Department, Mombasa, 1906.

This excellent map accompanies the "Hand-book for East Africa, Uganda, and Zanzibar for 1906." It shows in colours the seven provinces into which the southern part of the Protectorate has been divided. The northern portion has not yet been organized. The headquarters of provinces and districts and military and railroad stations are indicated.

EGYPT.—Geological Map of the Fayum Depression. Scale, 1:250,000, or 3.95 statute miles to an inch. Survey Department, Cairo, 1905.

This map is based upon the Geological Survey operations which were begun in 1898 in the desert surrounding the Fayum. The Fayum is a large circular depression in the Libyan Desert west of the Nile and to the south of Cairo. The depression contains about 12,000 square kilometers, and is divisible into cultivated land, lake, and desert, as shown in the map which accompanies a report on the "Topography and Geology of the Fayum Province."

AMERICA.

U. S. GEOLOGICAL SURVEY.

Reclamation Projects, Gaging Stations and River Surveys. Scale, 115 statute miles to an inch. Washington, 1905.

Accompanies the third annual Report of the Reclamation Service. Shows the principal reclamation projects, the areas within which public lands have been reserved for irrigation, projects under construction, approved, or under investigation, river gaging stations and river surveys. The Report also includes sketch maps of the Salt River, Milk River, and other important irrigation projects.

Map showing Location of Corundum Deposits in the United States. Bulletin No. 269. Washington, 1906.

Corundum was believed, a generation ago, to be a comparatively rare mineral, but it is now known to be widely distributed. It is found in most of the Atlantic States from Maine to Georgia and also in Montana, California, and Colorado.

(A) Map showing the Position of the Main Ground-Water Table on Long Island, N. Y. Scale, 1:62,500, or 0.9 statute mile to an inch. Washington, 1904.

(B) Map showing Water Work Systems of Long Island, N. Y. Scale, about 2 statute miles to an inch. Reduced from U. S. Geol. Sur. Atlas Sheets. Washington, 1903.

(C) Map of Long Island, New York, showing Location of Wells. Scale, about 2 miles to an inch. Washington, D. C., 1904.

These are among the maps which illustrate Professional Paper No. 44 on the underground water resources of Long Island. A shows the surface and ground-water divides, driven well stations of the Brooklyn Department of Water Supply, etc. B shows water mains, pumping stations, stand pipes, reservoirs and supply ponds, and gives the boundaries of the various waterworks systems. C shows well locations, groups of wells, etc.

Coal Fields of the United States, showing Areas of Coal-bearing Formations. Scale, about 110 statute miles to an inch. U. S. Geological Survey, Washington, D. C., 1906.

Accompanies Report (Professional Paper No. 48) on the operations of the coal-testing plant at the St. Louis Exposition in 1904. Localities that were sampled are indicated and the lignite fields of the Gulf States are shown.

UNITED STATES.—Geological Map of Essex County, Mass. Scale, 1:62,500, or 0.9 statute mile to an inch. By John H. Sears, Essex Institute, Salem, Mass., 1905.

This excellent map accompanies the book Mr. Sears has written on the "Geology of Essex County, Mass." Based on the Government topographic sheet, the scale is large enough to show the formations and outcrops. The contour interval is twenty feet.

UNITED STATES.—Map showing the Distribution of the Coal Measures of Maryland. Scale, 7 statute miles to an inch. By W. B. Clark and G. C. Martin. Maryland Geological Survey, Vol. V, Baltimore, 1905.

Shows in colours the distribution of the various coal formations and illustrates a long report by Dr. Clark and others on the coals of the State. The deposits are confined to the western part of Maryland, where for more than a half century they have been the basis of the State's most important mineral industry. This is one of the maps illustrating the elaborate report dealing with the coal deposits which has been in preparation by the Maryland Geological Survey for several years.

BRAZIL.—Vorläufige Skizze der Reisewege der Expedition Koch am Oberen Rio Negro u. Yapurá in den Jahren 1903-05. Scale, 1:4,000,000, or 63.1 statute miles to an inch. By Dr. Theodore Koch. *Zeitschrift* of the Berlin Geographical Society, No. 2, 1906.

The map illustrates Dr. Koch's four journeys, which embraced some wholly unexplored territory among the headwaters of the Rio Negro and the Yapurá

River. It accompanies the report of the ethnological and geographical work which he accomplished. Its distinctive feature is the distribution of the Indian tribes and their numerous villages on these waters, which mark the limits of the Amazon basin in this region.

GERMANY.—Verlauf des Kaiser Wilhelm-Kanals. Scale, 1:500,000, or 7.8 statute miles to an inch. Jahrbuch der Königlich-Preussischen Geologischen Landesanstalt und Bergakademie. Band XXIII, Berlin, 1905.

Shows the distribution of the coarse detrital material and the marine and fresh-water alluvium through which the canal was dug.

SWITZERLAND.—Karte des Oeschinen-Tales. Scale, 1:50,000, or 0.7 statute mile to an inch. Jahresbericht of the Bern Geographical Society, Vol. XIX, 1903-1904. Bern, 1905.

Accompanies a long paper by Dr. M. Gross on this beautiful mountain lake in the Bernese Oberland, to the study of which the author has brought all his resources. A map on a scale of 1:500 gives the profile of the lake bottom as revealed by numerous soundings.

POLAR.

ANTARCTIC.—Chart of the South Polar Regions. Scale of latitude, 1:14,000,000, or 220 statute miles to an inch. By J. G. Bartholomew, Edinburgh, 1905.

This map accompanies Dr. Mill's book, "The Siege of the South Pole." It is on a much larger scale than any other recent chart, and is a very fine product, containing all recent additions to our information, including Charcot's surveys of the outer coasts of the islands off Danco Land. The sea is coloured, to show the extent of the pack ice, tracks of all the explorers are given, and the scale is so large that no inset maps are required to show the details of the discovered coasts. Six small insets show the approximate limits of the unexplored area for the last 125 years.

ANTARCTIC.—Maps accompanying the "Rapports Scientifiques" of the results of the *Belgica's* voyage in 1897-98-99, published at the expense of the Belgian Government. J. E. Buschmann, Antwerp, 1903.

The maps include the route of the *Belgica* from Antwerp throughout her southern journey. In the Antarctic regions, the soundings, direction of the route or drift, the position of the icebergs, and the nature of the ice-pack are denoted. One sheet in colours is given to the surveys in Gerlache Strait.

OCEANIA.

NEW ZEALAND.—North Island. Scale, 14 statute miles to an inch. In the Report of the Department of Lands and Survey, New Zealand, for 1903-1904. J. W. A. Marchant, Surveyor General, Wellington, 1904.

Shows the principal waterfalls for electric power and the catchment areas of the New Zealand rivers. Insets give the names of seventy-eight waterfalls and the approximate areas of the catchment basins. A similar map in the same Report gives this information for Middle Island.

NEW ZEALAND.—North Island. Scale, 14 statute miles to an inch. In Report of the Department of Lands and Survey, New Zealand, for 1904-1905. Wellington, 1905.

Shows the state of the public surveys of the colony. Another sheet on the same scale gives similar information for Middle Island.

The Report for 1904-05 contains large-scale maps of North and Middle Islands showing the lands taken up during the year and lands available for settlement.

ATLASES.

ATLAS OF THE WORLD'S COMMERCE.—Compiled from the latest Official Returns at the Edinburgh Geographical Institute. Edited by J. G. Bartholomew. (Part 1.) George Newnes, London, and Frederick Warne & Co., New York, 1906. (Price per part, 25 cents.)

This is something new in the way of atlases, and it will fill an almost unoccupied field. The Atlas is to appear in 22 parts, of which No. 1 has been issued, and the other parts will be published fortnightly. They are sold in London at 6d. a part, or 11 shillings for the Atlas. The work will contain 176 quarto pages of coloured plates with more than 1,000 maps and diagrams, and text, including an alphabetically-arranged list of the principal commodities of commerce describing them and their geographical distribution. Part 1 gives an excellent idea of what the Atlas is to be. A double-sheet map of the world shows (*a*) the wheat-growing countries, areas being coloured to indicate large or small production; and (*b*) the lines of export. Five inset maps show the chief wheat-producing regions on a larger scale, and coloured, in the case of Europe and the United States, to show the number of bushels per square mile, and in India the percentage of net cropped areas devoted to wheat culture. The back of this sheet is given to a comprehensive and yet concise description of wheat, with six diagrams showing the production and consumption of the cereal and various phases of the commerce in it. The double-sheet map of coffee in commerce, with text on the back, may be similarly described. The dictionary of commodities in this part extends from *Abaca* to *Blubber,* with diagrams in the text. The preparation of this atlas has been in progress for several years, and, judging from Part 1, it is to be in every sense the most complete atlas of commerce that has yet been produced. Its predecessors have been especially intended for school use, while this atlas may not only be highly recommended to advanced classes in commercial geography but also to merchants as a superior reference volume.

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LONDON, COUNTY OF.—Stanford's New Map, on the Scale of 4 inches to 1 mile. In 20 Sheets, each 16⅜ x 14⅜ inches. Coloured. London, Edward Stanford. 1905.

[LONG ISLAND, North Shore of, from Manhasset Bay to Huntington Bay.] Showing the Breeding Places of Mosquitoes. Accompanying Report of the North Shore Improvement Association, 1901. Henry Clay Weeks, Engineer in Charge. *Scale* 3 inches = 1 mile. *Size* 53¾ x 36⅝ inches. New York, Copyrighted, 1902. [*Gift from John B. Uhle, New York.*]

MEXICO. Carta de la República Mexicana. *Scale* 1:100,000. [126 Sheets of the Survey Map, each 22 x 16½ inches.] Mexico, Secretaria de Fomento. 1896-1905.

NEW YORK, GEOLOGIC MAP OF, exhibiting the structure of the State so far as known. By Frederick J. H. Merrill, State Geologist. 1901. *Scale* 5 miles = 1 inch. 12 Sheets, each 21 x 25 inches. Albany, N. Y. University of the State of N. Y. [2 copies, one coloured, one uncoloured.] [*Gift from F. J. H. Merrill, State Geologist.*]

SELANGOR.—Federated Malay States, 1904. *Scale* 4 miles = 1 inch. *Size* 23 x 27½ inches. Compiled at the Revenue Survey Office, Selangor, from actual Surveys and various Explorations. Published by J. Bartholomew, The Edinburgh Geographical Institute. [*Gift from the Superintendent of Revenue Surveys, Selangor.*]

[SWEDEN.] FERNEBO [DISTRICT.]—Karta öfver Fernebo Härad. [Surveyed] 1863-74, [revised] 1894-95. *Scale* 1:50,000. 6 Sheets, each 20 x 28 inches. Stockholm, Rikets Ekonomiska Karteverk, 1896. [Accompanied by 38 pp. Descriptive Text.] [*Gift from Dr. Aksel Andersson, Royal University of Upsala.*]

[SWEDEN, SOUTHERN. Military Divisional Map.]—Karta öfver Rikets Indelning i Inskrifnings, Bataljons-och Kompaniområden, 1886-1895. *Scale* 1:1,000,000. *Size* 29 x 43 inches. Stockholm, Gen. Stab Lit. Anst. [*Gift from Dr. Aksel Andersson, Royal University of Upsala.*]

[SWITZERLAND.] BODENSEE UND RHEIN, Karte von. Mit den angrenzenden Gebieten von Baden, Württemberg, Bayern, Österreich und der Schweiz. Bearbeitet von Prof. F. Becker. *Scale* 1:125,000. *Size* 28½ x 14¼ inches. Bern, H. Kümmerly und Frey und A. Francke. [1905.] [*Gift from Prof. F. Becker, Zurich.*]

[SWITZERLAND.] GRAUBÜNDEN, H. Kümmerly's Touristenkarte von. *Scale* 1:300,000. *Size* 23 x 16 inches. Bern, H. Kümmerly & Frey und A. Francke. [1905.] [*Gift.*]

TRINIDAD, ROADS IN.—Sketch, prepared by R. Kernahan and H. Massy, 1898; Revised by Public Works Dep't (of Trinidad), 1904. *Scale* 3½ miles = 1 inch. *Size* 37 x 25 inches. Printed at the Ordnance Survey Office, Southampton. 1905. [*Gift from the Public Works Dep't of Trinidad.*]

TUNISIE, CARTE ROUTIÈRE DE LA. Au 1er Juillet, 1905, dressée par la Direction Générale des Travaux Publics. *Scale* 1:500,000. *Size* 27¾ x 39½ inches. Inset, Environs de Tunis, *Scale* 1:200,000. Paris, Erhard Frères. [*Gift from the Directeur Général des Travaux Publics, Tunis.*]

WASHINGTON, STATE OF.—Compiled from the Official Records of the General Land Office and other sources, under the direction of Frank Bond, 1905. *Scale* 1 inch = 12 miles. *Size* 34½ x 22¾ inches. [Washington, D. C.], Dep't of the Interior.

VARIOUS.

ABLETT, WILLIAM H.—English Trees and Tree-Planting. Sixteen Illustrations of Famous Historical Trees. London, Smith, Elder & Co. 1880. 8vo.

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[BIBLIOGRAPHY.] ANNUAL AMERICAN CATALOGUE, 1905. New York, Publishers' Weekly. 1906. 8vo.

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[BIBLIOGRAPHY.] AUCTION PRICES OF BOOKS.—A Representative Record arranged in Alphabetical order from the commencement of the English Book-Prices Current in 1886 and the American Book Prices Current in 1894 to 1904. . . . Edited by Luther S. Livingston. New York, Dodd, Mead & Co., 1905. 4 vols., 4to.

[BIBLIOGRAPHY.] ENGLISH CATALOGUE of Books for 1904. 69th Year of Issue. London, The Publishers' Circular, Ltd., 1906. 8vo.

BRADLEY, A. G.—Captain John Smith. [With Portrait and Map.] London, Macmillan & Co. 1905. 16mo. (English Men of Action Series.)

DICTIONARY. BUCKLAND, C. E.—Dictionary of Indian Biography. London, Swan Sonnenschein & Co. 1906. 8vo.

[DICTIONARY, FRENCH-BRETON.] LE GONIDEC, [J. F. M. A.]—Dictionnaire Français-Breton; Dictionnaire Breton-Français. Enrichi d'Additions, etc., par Th. Hersart de la Villemarqué. Saint Brieuc, L. Prud'homme. 1847-1850. 2 vols., 4to.

ENCYCLOPEDIA, JEWISH.—Vol. XII. Talmud-Zweifel. Illustrated. New York and London, Funk & Wagnalls Co. 1906. 8vo.

[ENCYCLOPAEDIA.] MEYERS Grosses Konversations-Lexikon. (6te Auflage.) Band XII, L-Lyra. [Illustrated.] Leipzig u. Wien, Bibliographisches Institut. 1905. 8vo.

FOSTER, JOHN W.—American Diplomacy in the Orient. Boston and New York, Houghton, Mifflin & Co. 1903. 8vo.

FOSTER, JOHN W.—A Century of American Diplomacy: Being a brief Review of the Foreign Relations of the United States, 1776-1876. Boston and New York, Houghton, Mifflin & Co. 1902. 8vo.

HAHN, F.—Die Eisenbahnen, ihre Entstehung und gegenwärtige Verbreitung. Mit einer Doppeltafel und Abbild. Leipzig, B. G. Teubner. 1905. 16mo.

HAMY, E. T.—Joseph Dombey: Médecin, Naturaliste, Archéologue, Explorateur du Pérou, du Chile et du Brésil. (1778-1785.) Sa Vie, Son Œuvre, Sa Correspondance. [Portrait, etc.] Paris, E. Guilmoto. 1905. 8vo.

HARTLEBEN'S KLEINES STATISTISCHES TASCHENBUCH über alle Länder der Erde, 1906. Bearbeitet von Pr. Dr. F. Umlauft. Wien u. Leipzig, A. Hartleben. 1906. 16mo.

HUMBOLDT, ALEXANDER VON.—Kosmos. Entwurf einer physischen Weltbeschreibung. Stuttgart u. Tübingen, J. G. Cotta. 1845-1862. 5 vols., 8vo.

LIZNAR, J.—Die Barometrische Höhenmessung. Mit neuen Tafeln. Leipzig u. Wien, Franz Deuticke. 1904. pr., 8vo.

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PLATANIA, GAETANO, ET PLATANIA, GIOVANNI.—Effets magnétiques de la foudre sur les roches volcaniques. [*Extract.*] (*Comptes Rendus des Séances de l'Académie des Sciences, 1905.* Paris, Gauthier-Villars.) pr., 4to;
SUL MAGNETISMO prodotto da Fulminazioni. *Estratto dalle Memorie della Classe di Scienze della R. Accademia degli Zelanti, 3a Serie, vol. IV, 1905-1906.* Acireale. 1906. pr., 8vo.

SCANDLIN, CHRISTIANA.—Hans, the Eskimo. A Story of Arctic Adventure. Illustrated. New York, Silver, Burdett & Co. (1903.) 16mo.

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WILDERMANN, MAX.—Jahrbuch der Naturwissenschaften, 1904-1905. Freiburg-im-Breisgau, Herdersche Verlagshandlung, 1905. 8vo. [*Gift.*]

ZEITSCHRIFT DES DEUTSCHEN UND ÖSTERREICHISCHEN ALPENVEREINS.—Band 36, 1905. [Maps and Plates.] Innsbruck, Verlag des D. und O. Alpenvereins.

BOOK NOTICES.

Guida dell' Abruzzo, di Enrico Abbate. Prima Edizione. pp. viii+558 (maps in pocket). Ermanno Loescher & Co., Roma, 1903.

A very handsome map of the Abruzzo, coloured, and six sectional ones, after the manner of the yet unsurpassed Dufour Atlas of Switzerland, accompany this volume, the title of which as "Guide" is entirely too modest. It is far more than a guide. It is a thorough, systematic description, from a standpoint of observation, study, and research, of that portion of Italy hitherto least known, because least accessible, and the Alpine Club (Roman section), as well as the author, may justly be congratulated on the production of such a meritorious work.

It is superfluous to dwell on the value of the geographical portions of such a description; the mere fact that it is published under the auspices of the Italian Alpine Club guarantees its excellence. The chapter on Geology and Mineralogy is especially interesting, through the full detail it gives of the structure of the Apennines. Quoting Verri, the author says: "Imagine a sheet of metal marked with undulations from the northwest to the southeast, incline the sheet to the west and bend it like a bow in the direction of its length; like this, to me, is the backbone of the Central Apennine, with its elevations and depressions." The principal formations are the Triassic, the Jurassic and, particularly, the Cretaceous and Tertiary. A list of characteristic fossils is given in each instance. The author mentions an emersion of the land—general at the time over Europe—at the close of the Tertiary period, and another of the Abruzzo at the end of the Pliocene. Of glacial action there are many very interesting evidences, showing vestiges at an altitude that exceeds 2,000 meters, and even reaches 2,400. While in central Italy volcanic phenomena appear mostly during the glacial epoch, in the Abruzzi the traces are confined to strata resting immediately on the Pliocene. To-day volcanic action is limited to mud-volcanoes and to a few sulphurous springs of little practical importance.

The author regards man as having been "a witness of all the phases that accompanied the glacial epoch," and recounts a number of finds in caverns of implements of the most primitive types; without, however, alluding in a direct manner to animal remains accompanying them, except in so far as they have furnished the material for artifacts. Hence his assumption of the existence of man at the very remote period when the country was under the pressure of glacial action is as yet insufficiently supported. He says: "No object has been found which bore traces of design like those discovered in other places; they were perhaps made in bone or wood, materials easily destroyed, and in this way failed to reach us." An abundance of weapons has been found locally gathered, as if they had been manufactured there for the purpose of commerce with other centres.

Valuable and written with much caution is the section on history. The many obscure points concerning the possible origins of those inhabitants of whom early documentary information exists are treated with due circumspection, and what is not established is left in doubt. Latin authors, of course, furnish the first and earliest data, and the contests between the Sabines and the Romans have left much material illustrating the period between the fourth and seventh centuries of the Roman era. The Middle Ages are a fertile field, and the historical notes are carried to the period after the fall of the Bourbons in 1860.

According to reliable data, the population of the Abruzzo has, since 1500, increased from a quarter of a million to 1,136,159 at the present day, which increase appears to have been quite uniform. Descriptions of the physical appearance and character of the people are concise and guarded at the same time. The remarks on the language tell us that no trace is discernible in it of the ancient Oscan. Signor Abbate considers the dialect now spoken as a mixture of the Neapolitan with that of the Roman Campagna and survivals of the language that may have sprung up after the Roman conquest.

Lengthy but by no means tedious descriptions of the three groups into which the land is geographically and politically subdivided follow a very interesting discussion of Abruzzan art from the earliest time to this day, and the indispensable review of economic conditions. The book closes with chapters specially designed for tourists. Less than a quarter of a century ago such a guide to the Abruzzo could not have been thought of, owing to the social and political state of that country. The mere fact of its issue is a sign of the great strides Italy has made and is making in the road of progress. A. F. B.

Mémoire sur les Migrations des Tsiganes à Travers l'Asie. Par M. J. de Goeje. viii + 91 pp. E. J. Brill, Leyden, 1903. (Price, 2 fr.)

The learned author gives the results, in this little book, of his studies concerning the origin of the Gypsies and their wanderings from their ancient home in northwest India. He shows that the Gypsy immigrants, both into Europe and Egypt, had a common origin in the basin of the Indus, but that their original speech naturally acquired differing foreign elements as they travelled slowly westward. The language, for example, of those European gypsies who, in 1417, emigrated from Hungary into Germany, had a large admixture of Greek and Armenian words which were, of course, lacking in the speech of their fellows who went to Egypt and on the way adopted many Persian and Arabic words into their vocabulary. He shows from Arabic sources that the Gypsy emigrants left India much earlier than had formerly been supposed.

Siberia. A Record of Travel, Climbing, and Explorations. By Samuel Turner. xxiv + 320 pp. Numerous Illustrations, two Maps, 3 Appendices, and Index. A. Wessels Company, New York, 1905.

The author is a London business man who went to Siberia to study the enormous growth of butter production and the prospects of the industry in relation to the London daily markets. He is also a mountaineer; and as his business was concluded when he was within 400 miles of the highest Altai mountains, he devoted the remainder of his stay to the exploration of that largely unknown region which includes the Katunskië-Belki, the highest range of Central Siberia. It was his privilege to climb Belukha, the highest mountain yet discovered in Siberia. The larger part of the book is devoted to his winter expedition to the Altai, and to his journeys, shooting expeditions, and climbing among the mountains, together with his impressions of the inhabitants. Thus, on a business mission, the author was able to render some geographical service in a neglected region. The chapters in which he describes the wonderful development of cattle-raising and butter production are of absorbing interest, and the subject is more fully treated than heretofore in English. He says the butter output is now 80,000,000 pounds a year, and is capable of being increased fifteenfold. Most of the excellent illustrations are from the photographs by the author. The Altai Flora is described in pp. 375-415.

Zur Verständigung über die Begriffe Nation und Nationalität. Von Alfred Kirchhoff. 64 pp. Verlag der Buchhandlung des Waisenhauses, Halle a. S., 1905. (Price, M. 1.)

A discussion of the real meaning of the words Nation and Nationality, illustrated by many facts of history and by quotations from the writings of statesmen and sociological investigators.

Die Abstammung des Menschen. Von Wilhelm Bölsche. 99 pp. and numerous Illustrations. 24th Edition. Kosmos, Gesellschaft der Naturfreunde Stuttgart. (Price, M. 1.)

The Kosmos Society at Stuttgart is stimulating the love of nature and acquaintance with its phenomena by publishing at a very cheap price small books like this one on various phases of natural history. The books are designed for the widest circle of readers, and any one of them may be perused in a few hours. The present volume, on the descent of man, is based on evolution as expounded by Darwin and Haeckel. A number of the illustrations are introduced to show the points of resemblance between the human embryo and that of some of the lower animals. The rather striking picture in colours on the title-page shows one of our progenitors in the Ice Age proudly erect on the body of a giant mammoth he has just killed and brandishing his spear over the victim of his prowess.

Mathematische Geographie (**Miniatur-Bibliothek, 671-673**). **Von Franz Baur.** 140 pp. and 21 Figures. Albert Otto Paul, Leipzig. (Price, 30 pf.)

A 16mo volume dealing with the size, shape, weight, and movements of the earth and heavenly bodies, the determination of geographical positions, etc. A clearly-written, though brief, manual, which requires on the part of the reader considerable knowledge of plane and spherical trigonometry.

An Introduction to Practical Geography. By A. T. Simmons and Hugh Richardson. pp. 380. Macmillan & Company, London, 1905.

Simmons and Richardson's Introduction to Practical Geography is a small volume, containing twenty-five chapters of suggestions as to practical work in geography available for field and laboratory. The difference between physical geography in America and England is shown by the fact that fourteen of the twenty-five chapters are devoted to mathematical geography and maps, seven to the atmosphere, and one each to rivers, the sea, plant geography, and man's dwelling-place.

Many of the exercises are too detailed for use in American schools, but all are suggestive, and many are extremely ingenious. The graphic representations of the simpler map projections are very helpful, and the problems in longitude, time, and climate are very pertinent. The book deserves to be consulted by every teacher of physical geography who would depart from the somewhat formal laboratory work of American schools. R. E. D.

The Egyptian Sudan. By J. Kelly Giffen. 252 pp. Maps and Illustrations. Fleming H. Revell Company, New York. (Price, $1.00.)

Very little has been written about the Anglo-Egyptian Sudan since Kitchener put an end to the Mahdist tyranny and the Sudan was once more opened to civilization. Great work has been done there, and this book is a desirable contribution to the story of the development of this part of Africa.

The two lines on which the Anglo-Egyptian Sudan is developing relate to its agricultural and commercial prospects and possibilities, and to the educational and humanitarian interest. Dr. Giffen's book deals with the country in both these interesting aspects; and as he has lived there for years and has devoted his life, as a missionary, to the welfare and enlightenment of the people, he was especially qualified to make the book instructive. He describes the Sudan as far south as the great Sobat, tributary of the Nile, where he founded a missionary station. He says that although the climate of any part of the Sudan is trying, it is possible for the white man to live there and do good work. Frequent changes may be necessary, however, to preserve health.

A Yankee in Pigmy Land. By William Edgar Geil. x and 364 pp., and many Illustrations. Dodd, Mead & Company, 1905. (Price, $1.50).

Mr. Geil would have immortalized his name if his crossing of Africa had occurred thirty years ago; but these trans-continental journeys are not an uncommon occurrence to-day, and most of them, like Mr. Geil's trip, are facilitated by the steamboat and railroad.

The book is the story of what its author saw during his journey from Mombasa, on the Indian Ocean, to the mouth of the Congo by way of the great tropical forest inhabited by pygmies to the west of the Albert Nyanza. It is full of interest and information. Nearly one-fourth of the space is given to the pygmies, and probably no other book contains so many photographs of these little people. The many suggestions as to equipment and hygiene offered to travellers in tropical Africa will be helpful. That region is to-day in a transition state, and an occasional book like this is especially desirable as giving a bird's-eye view of the latest phases of progress.

Hans the Eskimo. A Story of Arctic Adventure. By Christiana Scandlin. 125 pp. and 25 Illustrations. Silver, Burdett & Co., New York. (Price, 42c.)

The purpose of the book is to present a simple narrative of Eskimo home life, and especially to give school children an account of the lives of the little children of the far north. The book idealizes the character of Hans Henrik, and the facts used are confined to the stories he told on Kane's vessel, the *Advance*, as they appear in Kane's "Arctic Explorations."

We think the author's purpose might have been even more fully served if she had based her book upon the complete memoir of Hans which he wrote in the Eskimo language. This memoir was translated by Dr. Henry Rink and printed in *The Geographical Magazine*, Vol. 5, 1878. Dr. Rink translated the story because he had never read any adventures in the far north that were so curious and which so fully reflected the ideas and mental development of the Eskimos. The memoir covers not only the period of Kane's work but also the later expeditions of Hayes, Hall, and Sir George Nares, with all of whom Hans served.

The Junior Geography, By A. J. Herbertson, Reader in Geography in the University of Oxford. 288 pp., 166 black-and-white maps, and Index. Clarendon Press, Oxford, 1905.

The volume covers the regional geography necessary for the Oxford junior examinations. It is Vol. 2 of the Oxford Geographies, and the preliminary volume, in course of preparation, will deal especially with physical geography.

The type is large and clear, the maps remarkably numerous for so small a book, and every part of the world is described in some of its geographical aspects. Naturally, the quantity of letterpress cannot be great, and quality must be substituted if the book is to have any usefulness.

The book may fairly claim to be of high quality. It deals chiefly with physical features and the distribution of population, commodities, climates, etc., over the world's surface. It is limited to the most conspicuous and suggestive facts. The small black-and-white maps have abundant information, but the execution of many of them hardly equals even the American standard. The book is full of suggestiveness to the teacher, and in the hands of a competent instructor may easily be expanded into a course of practical geography.

Tibet and Turkestan: A Journey Through old Lands and a Study of New Conditions. By Oscar Terry Crosby. xvi and 351 pp. Numerous Illustrations, 19 Appendices, Map in Colours, and Index. G. P. Putnam's Sons, New Yock, 1905.

Mr. Crosby's visit to Tibet was confined to the remote northwest corner of that country. He explored and he describes vividly the desolate nature of this part of the lofty plateau called Aksai Chan. Travelling for eight weeks at altitudes of 15,500 to 18,500 feet, the cold was intense, and the little party barely escaped with their lives. Mr. Crosby says that the hardships of the journey were in every respect more severe than those he experienced in Africa while travelling from Somaliland to Khartum.

In his account of Tibet the author tries, as too few explorers do, to see the inhabitants from their own point of view, and to discover how far their environment is responsible for their social and other peculiarities. The illustrations are admirable; but the three views in Lhasa might more properly have been credited to the Imperial Russian Geographical Society of St. Petersburg, which made these reproductions of the photographs taken by the Buriat Dorjieff, than to the National Geographic Society of Washington.

Hinter den Kulissen des Mandschurischen Kriegstheaters, Von Max Th. S. Behrman. 368 pp. and Map. C. A. Schwetschke & Son, Berlin, 1905. (Price, 4 M.)

Letters written by a war correspondent from Harbin and other points in the rear of the actual scene of the hostilities in Manchuria. The book, covering the period from March, 1904, to the end of the war, gives many views behind the scenes and statements of fact and opinion which were not permitted to reach the world during the progress of the war.

Two Years in the Antarctic. Being a Narrative of the British National Antarctic Expedition. By Albert B. Armitage. xix and 315 pp. Numerous Illustrations, Map, 4 Appendices, and Index. Edward Arnold, London, 1905. (Price, $4.)

This book deals only with incidents of the work and experiences of the last British expedition to Victoria Land. The author does not discuss Antarctic problems nor advance scientific theories, but tells the plain story of the life of about fifty men during their long sojourn in the South Polar regions. The book is well illustrated, and the letterpress is interesting, as it could hardly fail to be with such a wealth of incident at hand. For those who care to learn from a book on the Antarctic only of the life and occupations of polar adventurers this volume will be satisfying; but if the reader wishes to get an idea of the scientific results of the Discovery Expedition and is interested in the theories and speculations to which such an expedition gives rise, he will have to read Captain Scott's large volumes.

The Elements of Geology. By William Harmon Norton. x and 461 pp., 374 Illustrations, Diagrams, Maps and Index. Ginn & Company, Boston, 1905. (Price, $1.40.)

The author takes in turn the external and internal geological agencies and treats in connection with each of these processes the land-forms and rock structure which it has produced. Thirteen chapters are given to these principles and illustrations of physical geology and the final nine chapters to the historical view of the science. Especial attention is given in the historical section to North America, and the only map in colours is a geological map of the United States and a part of Canada. The book is simply planned, richly supplied with half-tone illustrations and small maps, is not overloaded with details, and is in every way an attractive book to put in the hands of the young student.

Erdkunde für Höhere Lehranstalten. Von Dr. Adolf Pahde. Part I: Unterstufe. vi and 108 pp., 36 Illustrations, and Index. (Price, M. 1.80.) II: Mittelstufe, Erstes Stück. iv and 134 pp., 8 Illustrations and Index. (Price, M. 1.80.) III: Mittelstufe, Zweites Stück. v and 169 pp., 14 Illustrations, and Index. (Price, M. 2.40.) IV: Mittelstufe, Drittes Stück. iv and 148 pp., 4 Illustrations, and Index. (Price, M. 2.) V: Oberstufe. v and 142 pp., 39 Illustrations and Index. (Price, M. 2.50.) Carl Flemming, Glogau, 1905.

These small text-books are intended for the several grades in the high schools and lead up to courses in the gymnasia. Vol. I deals with the fundamental principles of geography, the shape and movements of the earth, and presents the essential facts relating to the continents and a concise treatment of Germany; Vol. II and III are devoted to the other continents; Vol. IV contains a fuller discussion of Germany, and Vol. V is given to mathematical, physical, and biological geography, map projections, and commercial highways. The books are meant to meet the fact that the time given to geography in the "Höhere Lehranstalten" is short. The choice of matter is excellent, and the style is marked by simplicity of statement and brevity of sentences. The series will be most useful in the hands of thoroughly-equipped teachers, for such instructors will find it full of suggestion for the amplification of each topic.

Jahrbuch der Naturwissenschaften, 1904-1905. Edited by Dr. Max Wildermann. xiii and 537 pp., 28 Illustrations, and an Index covering the volumes for 1900/1–1904/05. B. Herder, St. Louis, Mo., 1905. (Price, $2.)

The twentieth issue of this volume maintains its high reputation as one of the best periodical records of scientific progress. A section is given to each of the thirteen leading branches of science, and all the more important phases of discovery and progress in each field, for the year under review, are described by specialists. Among the sections of special interest to geographers are geography, mineralogy and geology, anthropology, ethnology and archæology, meteorology, zoology, and forestry and agriculture. The index and obituary list cover the last five volumes. The work is admirably edited, the index makes all information available, and the book is not only an accurate reference volume but also a work that will interest many general readers.

Panama to Patagonia. The Isthmian Canal and the West Coast Countries. By Charles M. Pepper. With Maps and Illustrations. pp. xxii–400, 8vo. Chicago, A. C. McClurg & Co., 1906.

Mr. Pepper has written a book that is pleasantly unpretentious and handsomely illustrated. The maps are as good as they can be, fully answering their purpose. Statistics, tables of distances, indications in regard to climate and vegetation, abound, and they are mainly correct. The journey of Mr. Pepper encompassed the whole South American coast from Panamá to Punta Arenas, some of the Peruvian interior, and great part of western Bolivia. Most of his observations on the present condition of the countries he visited are just, showing that he saw with unprejudiced and intelligent eyes and listened attentively to good sources of information. There are, of course, a number of misstatements in regard to the early past, and some queer appreciations of art and architecture; but as the author makes no pretence to treat of such matters authoritatively, it would be unjust to chide him. His purpose is "to consider and describe the effect of the Panama Canal on the West Coast countries of South America from the year 1905," and he has honestly endeavoured to attain it. He justly says:

> The effort to divorce economic and social forces from places and peoples in order to analyze a principle usually is so barren that I have not attempted it. Places have their significance, and people are the human material. Customs and institutions are only understood properly in their environment.

A. F. B.

Das Problem der Völkerverwandtschaft. Von Dr. Joh. Richard Mucke, ord. Professor an der K. Universität Jurjeff (Dorpat). Greifswald, Verlag von Julius Abel, 1905. (Pr., M. 7.50.)

The main purpose of this book is to disprove the common theory of an "Urvolk," which the author denounces as unscientific, because it constructs, first, an imaginary nation in order to explain the existing ones, and, then, an imaginary country from which said nation is supposed to have spread. To put the discussion upon a more scientific basis he pursues his investigations by a strictly "geographico-statistical" method, collecting facts from all available records of history and ethnology, examining the "geographical individual" from which each observation is recorded, and from the material thus classified in a card catalogue of some 35,000 cards he has gained the conclusion that the idea of a common origin of the nations by migration from some original centre, whether we call it Aryan or otherwise, must be entirely abandoned. His opinion is that every nation has grown up more or less strictly on the same geographical individual which it occupies in the present, and that its origin is due to an amalgamation of highland and lowland peoples. Whether in South America, in ancient Greece, or in Tacitus's Germania, everywhere the same two components of the population present themselves: one, with common characteristics, occupying the low parts of the country, along rivers and by lakes or swamps; the other, with as distinct characteristics of its own, on the hills, interspersed among the former.

Under primitive conditions, when the two components still existed separately, the ethnological unit was the *"horde,"* often inadequately called clan, tribe, family, etc.—namely, a group of people camping or housing together and connected by blood kinship. The character of their common habitation he defines exclusively as a resting-place, emphatically denying that the desire for protection should have anything to do with its origin. As some may disagree with him on this point, it is to be regretted that, of all the assertions made in the book, this should be the only one which is not supported by positive facts. The shape of the camp, and of the later house, was given by the habits of the *horde* of lying down to rest, and this was, in its turn, predestined by the geographical individual on which they camped—namely, in straight parallel rows along the rivers, in "round rows" (?)—*"Rundreihen"*—on the hills. Thus the long-house and the round-house are found as the two primitive forms of house-building all over the world. The space thus covered by the *horde* is the "dwelling space" (*Wohnraum*), in distinction from the "living space" (*Lebensraum*), which includes the area which furnishes the horde their means of living. The concept *horde* in the fullest of its meaning includes, then, (*a*) the dwelling space, (*b*) its occupants, (*c*) the special order maintained on that space, (*d*) the boundary of that space.

As long as the *horde* lives a separate life for itself, sexual relations are naturally endogamous, so that the language even makes no distinction between brother and husband, father and uncle ("avunculate"). Thus neither matriarchy nor patriarchy can claim to have stood at the beginnings of society, both having evolved, not from promiscuous intercourse, which is a sign of decadence wherever found, but from the primitive intercourse between "brothers and sisters"—viz., blood relations constituting the *horde.* The author's explanation of how intercourse between blood relations came to be avoided is perhaps the best that has ever been given, because it works entirely without instincts or the awakening of a "moral consciousness" to the horror of incest. It is based on the distinction between *matrimonium* and *familia.* The plain facts which he gives are these: Within the *horde,* where all are of the same kin, there are no masters and no servants. If one of them stands out as a *primus inter pares* the relation of the other members of the *horde* toward him, as toward each other, is only one of *obsequentia,* not of *obedientia.* No husband-brother can thus be the master of his wife-sister, nor can she be his mistress. For service, they capture outsiders: the women are given strangers to do men's, and the men to do women's, work for them. These outsiders, who must not enter the common house, live in huts near, or annexed to, it. Sexual intercourse will occur between master, or mistress, and servant; their children, then, are considered the master's and his sister-wife's, or the mistress's and her brother-husband's children—viz., members of the *horde,* their natural father or mother not counting at all; in case of war, they will even fight against their own ancestors and relatives outside of the *horde;* they are not considered their relatives. This is the germ of matriarchy and patriarchy. In the course of time the community of interests between the servant-husband or wife and the mistress or master will cause the member of the *horde* to follow him or her into the outside hut, leaving the common house, and thus we obtain the *family*—viz., a relation founded on service, where *obedientia,* not *obsequentia,* is the foundation, and in which marriage has lost its character of a partnership among equals, which it had been in the *horde,* where either husband or wife reigns supreme. The more it became an established custom, the less possible would it become for a brother or sister to "marry" each other in the new conception of the word, until gradually tradition established a divine commandment to avoid such marriages.

The common house is now deserted; its inhabitants, if any, are only unmarried members of the former *horde*, or it becomes a mere club or meeting-house for the tribe. For now the *horde* has ceased to exist; it has become a *tribe*—viz., a congregation of families, composed of native and foreign elements, in which *obedientia* reigns; the chief is an actual monarch, whether he has the title of one or not, and it has an aristocracy, in which the descendency from *horde* origin is expressed. This aristocracy often has a "secret" language; it is the old *horde* idiom, preserved among those of the purest blood; other tribes are reported to have a special "women's language": the idiom of the foreign wives, preserved among their descendants, while the general language of the tribe is the product of assimilation between *horde* and foreign elements.

The long-house of the lowland *horde*, constructed on a moist soil exposed to inundation, was the original pile dwelling. In trying to raise the floor of their dwelling the *horde* utilized trees, and, where no trees were found, artificial piles were driven into the ground to build the houses on. From these pile dwellings it was only one step to the real lake dwelling, and lowland *hordes* and lake dwellers are practically synonymous. This correlation is very strongly supported by the legends of the nations whose origin can be traced to the lowland *hordes*, which, when stripped of mythical additions of later times, show in a most striking manner the relations of their forefathers to the moist element. Their occupation, in the rich bottom-lands, was agricultural, while the highland *hordes*, in the seclusion of their individual aggregations, became the originators of arts and crafts, and thus of the industries. The desire to have at their command persons with such different talents caused the captures of members of the different *hordes* from which the family and tribal relations evolved. This constant assimilation of most heterogeneous elements created relationships of nations and of languages which have as yet never been studied from this point of view by the philologists, and while space does not allow to enter here into any detail about the ways in which, both in following up national myths and tracing primitive word-stems, the author carries on his deductions, it is certain that no ethnologist or linguist interested in the problem can afford to let them go unnoticed; for they promise to put the discussion upon an entirely new basis.

So much more is it to be regretted that the author does not shrink from depreciating the work of other scholars in order to show the merits of his own, and it takes a fair-minded reader not to lay the book aside with disgust at his abuse of names like Ratzel and Schurtz because he fails to see in what line the merits of the "people with ideas" are to be found. Even if we admit that their work is incongenial to such an exact thinker as the author, and that parts of it will be superseded in the course of time by the results of later investigations, calling them "superficial," "bereft of judgment," "possessed of fixed ideas," does not disprove them. Anybody able to wield the weapon of such overwhelming argument—as, for instance, Dr. Mucke does—against Schurtz on the subject of the use of the common house as the men's house (*versus* Sch.'s "Männerbünde") only debases himself by poisoning his weapon as he does, and so much more if they for whom the venom is intended are no longer on the field of battle. The book was published in 1905, Ratzel died in 1904, and Schurtz even in 1903. If these passages were written before that time, common decency ought to have prompted the author to take them out before publication. Moreover, it is evident for any one "who has not yet, by self-made associations and empty fancies, been reduced to that abnormal condition of the brain which we call fixed idea" that in a majority of cases he evidently misunderstands or misinterprets Ratzel's words. If this may be excused in one who probably never worked with the originator of anthropogeography, there is nothing that will acquit him of the charge of unfairness in attacking a man in 1905 for what he said in the first edition of his book more than twenty years ago, when in the second edition, of 1899, a great percentage of the very passages on which the criticism is based had been *omitted*. As to obscurity of expression and triteness of style, sentences like these: "*Horde* is the relation of reciprocity between space and the group of people who live on it," or "Wherever man lives, he lives on a certain space. But this space becomes a living space only by his living on it. There would be no living space if nobody lived on it, and there would be no living without a space on which to live," do not prove that the author's style is free from the defects which he blames in others. He will oblige his readers if in a second edition he spares them the unpleasant task of working their way through pages and pages of disparaging remarks in order to get what valuable material is imbedded in them, especially in the first two chapters, and he will serve his own interest best of all by thus enabling us to give him full credit for his work without having first to overcome the disgust caused by his way of presenting it. M. K. G.

Natur und Arbeit. Eine allgemeine Wirtschaftskunde von Prof. Dr. Alwin Oppel. Two vols. With numerous illustrations, plates, and maps Leipzig and Vienna, Bibliographisches Institut, 1904. (Pr., M. 20.)

Another of the beautiful "popular" handbooks published by the Bibliographical Institute. It may be called a compendium of economics in the broadest conception of the word, and will prove a most valuable source both of instruction and reference for anybody able to read German. It contains, first, a discussion of the natural foundations of economic development, giving brief treatises on general geology, minerals, soils, the principles of oceanography and climatology, the vegetable and animal kingdoms, and the general principles of the economic progress of man; secondly, a history of economics, in which the economical stages of all ages and nations, from primitive man to the eighteenth century, are reviewed; and thirdly, the products, industries, and commerce of the nations of the present, which occupy the second part of the first and the whole of the second volume. While the conditions of the country in and for which the book was written are naturally given a large part of the book, it is far from being only a commercial geography of Germany, and readers of any nationality will find it an excellent source of brief information on the essential features of their own country in regard to the topics treated. The illustrations—those in the text as well as the coloured plates—are fully up to the reputation of the publishers, and the maps present in themselves a complete atlas of commercial and economic geography. The book ought to be given a place in the library of every commercial high school whose course stands for more than mere mechanical drill in the theory and practice of business. M. K. G.

Canada in the Twentieth Century By A. G. Bradley. xii and 428 pp., Map, 50 Illustrations, and Index. E. P. Dutton & Co., New York, 1904. (Price, $4.)

We have seen no book that gives so good a picture of Canada and Canadian life as is found in this work. The development of the Dominion has been remarkably rapid in the past few years, and inquiries have been made for a book of this general character. We are glad the want is supplied at last. Of recent books, Lumsden's is perhaps more thorough than this one in its treatment of the wheat and ranch regions of western Canada, but practically all of it is devoted to these prairie lands. Fraser's book is a panoramic view of the Dominion from sea to sea, giving the essence of many things but with briefest treatment of each topic. Every page of Mr. Bradley's work gives solid information in very readable form, and it treats of the whole Dominion excepting the maritime provinces of Nova Scotia, New Brunswick, and Prince Edward Island. But it is not overladen with data. There is much practical information which the immigrant may need, for example, that is not found in these pages. Little is told of the history, geography, or politics of the country, but the author, in no superficial manner, devotes himself to the life of all parts of the land and the conditions amid which the people are working out their problems. The illustrations are characteristic. The map should be revised for the next edition to insert the two new provinces of Saskatchewan and Alberta, and to show the present extent of railroad-building.

The wheat lands of the West, of course, cannot always be over-cropped; and to keep them in a high degree of fertility, the author thinks that the farmer will ultimately have recourse to turning under green crops, as clover does not seem to flourish in that region.

The Native Races of South Africa. By George W. Stow. Edited by George McCall Theal. xvi and 618 pp., 22 Illustrations, Map, and Index. Swan, Sonnenschein & Co., Lim't'd, London, 1905.

The author lived in South Africa from 1843 until his death, over twenty years ago. His widow sold the manuscript of this book to Miss Lucy C. Lloyd, who herself had devoted many years to the study of the Bushman race. Other work prevented her from giving the manuscript the care needed for its publication, and in 1904 she submitted it to Dr. Theal, who was convinced upon reading it that no production of such value upon the native races of South Africa had yet appeared. Several authorities on the races of South Africa have expressed high opinion of its importance.

The author drew a detailed and accurate picture of the mode of life, physique, beliefs, and environment of these primitive hunters, who were in the Stone age when Europeans first saw them, though, long before, some of the tribes had developed remarkable illustrative ability. The wall paintings of the Bushmen show many of the animals of South Africa more accurately than the drawings of European animals made by the European cave men. A considerable number of Mr. Stow's illustrations are in colours, showing the wall paintings, carved work, implements, rock chipping, etc., of the Bushmen and other tribes.

While a large proportion of the book deals with the Bushmen and their former life, a great deal of the valuable material relates to the Hottentots and their hybrids, the Damaras, and especially the great Bechuana, or Basuto section of the Bantu peoples. The author gives an interesting account of one of the strangest events in South African history—the invasion of the Mantati cannibals, who came down on South Africa from the northeast, sparing no human being in their way. The first missionaries had then reached the Bechuana country from the south, and they enabled the tribes among whom they had settled to make a successful stand against the invaders, who finally turned back to the unknown regions from which they came.

All the tribes of whom Mr. Stow writes in this book have to-day been more or less modified by their intercourse with the whites. It is fortunate that these fine studies of changing and vanishing peoples were written before the natives had come under the influence of the white race. There are imperfections in the book, for much study has been given to these races since Mr. Stow wrote; but his work is certain to be regarded as one of the most valuable compilations of anthropological material relating to the aborigines of South Africa.

The Story of the Zulus. By J. Y. Gibson. viii and 276 pp., Illustrations and Index. P. Davis & Sons, Pietermaritzburg, Natal, 1903.

Every white man in South Africa respected the power of the Zulu nation up to the time of the fall of Cetshwayo its last king, in 1884. The fame of this all-conquering people had spread farther than South Africa, and its greatness was the favourite topic among all the tribes. This book tells the story of the Zulus from an earlier day than the time of Tshaka, the first great Zulu king, in the early years of the last century, until after the annexation by the British of all that was left of the Zulu country in 1887. Mr. Gibson, who was for some years a magistrate in Zululand, has rendered a service in carrying through this literary task; for the time when reliable information may be obtained from Zulu sources is rapidly passing away. He evidently collected his data with much care, and has aimed at accuracy in all his statements. The author shows the Zulus in many phases of their lives and history; and it is certain that no barbarous African people has a more remarkable history than this small part of the great Bantu family.

Nach der Oase Tugurt in der Wüste Sahara. By Walter Baader. 250 pp. Buchdruckerei Kreis, Basel, 1903.

A sprightly narrative of travel written by a careful observer. Though the book adds nothing to our geographical knowledge, it deals with a region whose northern edge is visited by more and more tourists every year. The little work should be helpful to those who sojourn at Biskra, while at the same time it will interest the general reader. The author tells of the ruined fortifications at Biskra, reminders of the day now gone, when it was necessary to have defences along the edge of the Sahara as a protection against the incursions of desert nomads.

The Siege of the South Pole. By Hugh R. Mill. xvi and 455 pp., Illustrations, Map in Colours by J. G. Bartholomew, Appendix, and Index. Frederick A. Stokes Company, New York, 1905. (Price, $2.60.)

The only books in English on the Antarctic regions as a whole are Dr. Fricker's "The Antarctic Regions," and "The Siege of the South Pole," which has recently appeared from the pen of Dr. Mill. While both are authoritative works, they differ essentially from one another. Dr. Mill does not attempt to describe the polar regions or their peculiar conditions, but simply tells the story of Antarctic exploration up to the present time; while Dr. Fricker, after giving the history of discovery in that part of the world, devotes more than one-half of his book to a geological and geographical description of the regions visited.

But Dr. Fricker's scholarly book was written before any of the five recent expeditions had gone south; Dr. Mill's books completes the record of exploration, for it includes the Charcot expedition, which was the latest to enter and to leave the field. It is a well-knit recital of the whole story of South Polar endeavour, told with literary skill and, of course, with the geographical insight that marks all of Dr. Mill's writings. This is a book that every student or writer who has to do with polar topics must have within reach. Dr. Mill devotes a chapter to Wilkes, and does not belittle what he really achieved.

With the Abyssinians in Somaliland. By Major J. Willes Jennings and Christopher Addison. xii and 265 pp., 68 Illustrations and Sketch Map. Hodder & Stoughton, London, 1905. (Price, 10s. 6d.)

The authors had an opportunity to participate in the campaign of 1903-04 against the Mad Mullah in Somaliland, serving as medical officers in the Abyssinian army, which co-operated with the British force. The description of the new railroad from Jibuti, of the town of Harrar, formerly forbidden to non-Mohammedans, and of the military organization of the Abyssinians and their methods of carrying on a campaign, is of novel interest, and much of the book is about a country and people that have not yet been thoroughly studied.

Berlin and Its Environs. Handbook for Travellers. By Karl Baedeker. Second Edition. x and 247 pp., 6 Maps, 18 Plans, and Index. Karl Baedeker, Leipzig, 1905. (Price, M. 3.)

A thorough revision of this handbook to the largest purely modern city in Europe. A map of the city in three sections is on a scale of over 3 miles to an inch.

L' Eruzione dell' Etna nel 1892. Vol. I. Storia e Descrizione, con 6 Tavole e 7 Figure nel testo, **per A. Riccò e S. Arcidiacono,** R. Osservatorio, di Catania ed Etneo. 8vo. Catania, Stab. Tip. C. Galàtola, 1904.

The tokens of activity of a volcano may not be real life, but when described in a journal of observations they appear to constitute something more than mechanical manifestations. Volcanoes, if not properly "living mountains," are at least the most active ones. Next to them come, in the order of activity, the Alpine chains, with their constantly-changing glaciers.

It is an intensely interesting task to follow, day after day, hour for hour, the palpitations of one of the great safety-valves of the earth's crust, and when to ocular observation is added the unbroken record of sensitive instruments, we obtain a picture, not merely of the externally perceptible results of volcanic action, but, to a certain extent, of the internal processes that cause them. This is the great merit of the labours of the Royal Observatory of Catania in Sicily, part of the results of which are presented in this volume.

A detailed report on the eruptions of 1883 and 1886 precedes the body of observations on that of 1892, and details are carried so far, even, as to give the condition of the volcano almost daily after May of 1886. The regular Journal of Ætna's activity begins in July, 1892, and is continued to the end of the year (Part III), but further explorations and observations are added, till the end of October, 1896.

To follow in detail these studies far exceeds the limits of a review. It suffices to acknowledge the consummate care and conscientiousness with which they have been carried on, both by instrumental record and by ocular scrutiny. Nor is this volume the final word; the total results can only be appreciated when the work will be complete. But the map accompanying this first part gives an idea of, and foreshadows partly, these results. It establishes: that the eruptions of 1883 and 1886 took place considerably to the south of the central crater, and that, in continuation of the fracture then commenced, the eruption of 1892 advanced farther towards the summit of the volcano, around which cluster the hearths of the outbreaks of 1819, 1869, and 1879. The character of the eruptive areas, from 1883 to 1892 inclusive, therefore, justifies the designation of "radial fractures," applied to them by the observers of the Catania Observatory.

Most interesting outline sketches and valuable photographs adorn this important contribution to vulcanology and seismology. A. F. B.

Die Erde in der Zeit des Menschen (Leben und Wissen, Band 5). **By Willy Pastor.** 286 pp. Eugen Diederichs, Jena, 1904. (Price, M. 5.50.)

A readable book in which the author attempts to trace the history of the development of mankind. The essay is marked by much literary skill, but leaves many periods of time and many races of men entirely out of the account. The author especially emphasizes the importance of early religious faiths, which strongly influenced the development of languages and the invention of characters or hieroglyphics by which to record speech. He makes use of few of the discoveries or hypotheses of the anthropologists.

Captain John Smith. By A. G. Bradley. viii and 226 pp. and Map. Macmillan & Co., London, 1905. (Price, 2s. 6d.)

This is one of the volumes in the "English Men of Action" series in which a number of the foremost writers have written biographies of some of England's great men. These books are accurate and readable, and are sold for a small sum. The adventures of Captain John Smith have a romantic as well as an historical interest; for he was a man of thrilling experiences and many narrow escapes, and his deeds are a part of the history of pioneer days in Virginia. The author believes with the late John Fiske that the Pocahontas story was true, and he gives both facts and reasons for defending Smith's veracity. This book is one of the best of the series.

Ceylon in 1903. Describing the Progress of the Island since 1803. By John Ferguson. clxiii and 198 pp., numerous Illustrations, 9 Appendices, and Index. A. M. & J. Ferguson. Colombo, 1903. (Price 7s.)

The fifth publication of a work that, for over twenty years, has been one of the fullest and best sources of information concerning the island. Besides an historical review it contains the most recent facts on a large variety of topics and describes the present agricultural and commercial enterprises and the attractions which the island has to offer to tourists. The author asserts that British capital, invested in the development of coffee, tea, and other plantations, has been the largest influence in more than doubling the population and in greatly improving the condition of the Cingalese in respect of their education, houses, clothing, and food.

The Moravians in Georgia, 1735-1740. By Adelaide L. Fries. 252 pp., 15 illustrations, and Index. Printed for the Author by Edwards & Broughton, Raleigh, N. C., 1905.

The story of those industrious, fearless, conscientious Germans, long persecuted for their religious faith at home, who were permitted at length to seek refuge in Georgia, reaching Savannah in its earliest days. The movement was pregnant in results, though historians have largely ignored this first planting of a Moravian colony in America. The author's material concerning the Georgia settlers was drawn entirely from original manuscripts found in Germany and this country, and so far the book is a distinct contribution to the history of those pioneer days in Georgia.

OBITUARY.

WALTER R. T. JONES.

Walter R. T. Jones became a Fellow of this Society in 1871, and was elected Treasurer on January 12th, 1886. He discharged the duties of that office until his decease, which occurred in this City on March 26th last.

In the death of Mr. Jones this Society has lost a faithful and efficient officer and the community a worthy citizen.

Mr. Jones graduated from Columbia College (now Columbia University) in the Class of 1850, and, for the greater part of the year after his graduation, travelled in Europe. On his return to this City he studied law and subsequently engaged in the business of Average Adjusting in connection with Marine Underwriting.

His conservatism manifested itself in his continuing with the same associate in business for over half a century.

In 1854 Mr. Jones married Anna Pierson Bailey, daughter of Capt. Theodorus Bailey, United States Navy, who, after the Civil War, attained the rank of Admiral.

The fruit of this marriage was a daughter and a son. The son died in 1879, Mrs. Jones some years later, and the daughter, wife of Major C. W. Whipple, United States Army, with her five children, survives.

Mr. Jones possessed rare qualities of heart and mind, yet modesty and simplicity were his chief characteristics.

He was wise in counsel and of unswerving integrity; strong in his attachments, generous and considerate with his adversaries.

It is a pleasurable duty to make recognition of his worth while recording the loss to this Society in his death.

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BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY.

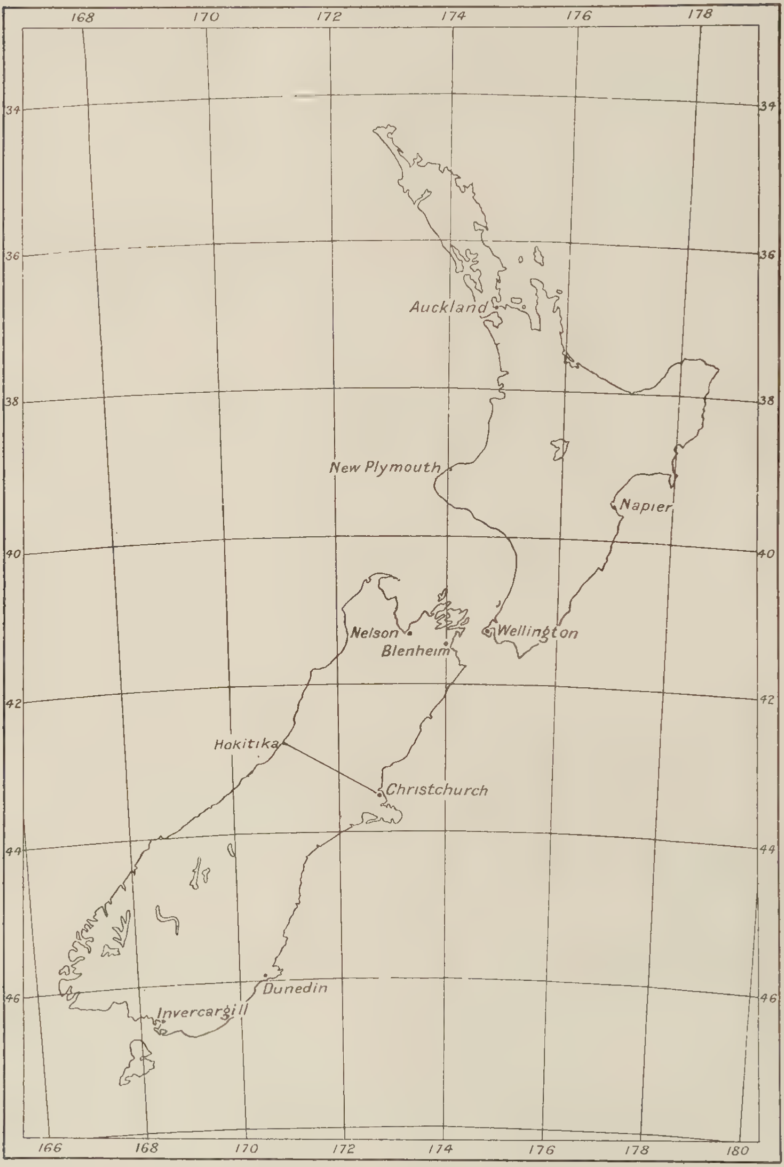
Vol. XXXVIII **1906.** **No. 5**

A PHYSIOGRAPHIC SECTION THROUGH THE MIDDLE ISLAND OF NEW ZEALAND.

The Middle Island of New Zealand, considering its relatively small size, presents a remarkably varied topography. A physiographic section from the city of Christchurch, capital of the province of Canterbury, to the town of Hokitika, capital of the province of Westland, exhibits many of the most interesting physical features. A line drawn from Christchurch to Hokitika is almost at right angles to both coasts of the Middle Island, and to the majestic Southern Alps, which form the backbone of the Island. Hokitika lies about 105 miles North 55′ West of Christchurch: in latitude 42° 43′ South: the latitude of Christchurch being 43° 33′ South.

On the western slope of the mountains, the main rivers—the Taramakau, the Arahura, and the Hokitika—flow to Tasman Sea in a general northwesterly direction, while, on the opposite slope, the Rakaia, with its tributary the Wilberforce, and the Waiamakariri have a general southeasterly flow to the Pacific Ocean. In other words, the main drainage channels are almost at right angles to the island-divide. The descent towards the west is much more rapid than towards the east, the distance from the ocean being on the one hand approximately 29 miles and on the other about 76 miles.

Looking from the summit of Mount Harman, which ascends some hundreds of feet above Browning's Pass, at the head-waters of the Arahura and of the Wilberforce, on a clear day one can see in the distance to the westward the broad expanse of the Tasman Sea, and to the eastward the mighty bosom of the Southern Pacific. North-eastward and south-westward runs the backbone of the Middle Island, the great mountain-chain of the Southern Alps. To the south-westward the chain can be seen gradually to increase in altitude, culminating in Mount Cook, a splendid monolith 12,349 feet high. Close to Mount Cook are its mighty rivals Mount Tasman, Mount Haidinger, and Mount La Perouse, which are all over 10,000 feet in height. Around these mountains and partly covering them is the huge "mer de glace," in which rise the principal glaciers of



OUTLINE MAP OF NEW ZEALAND.

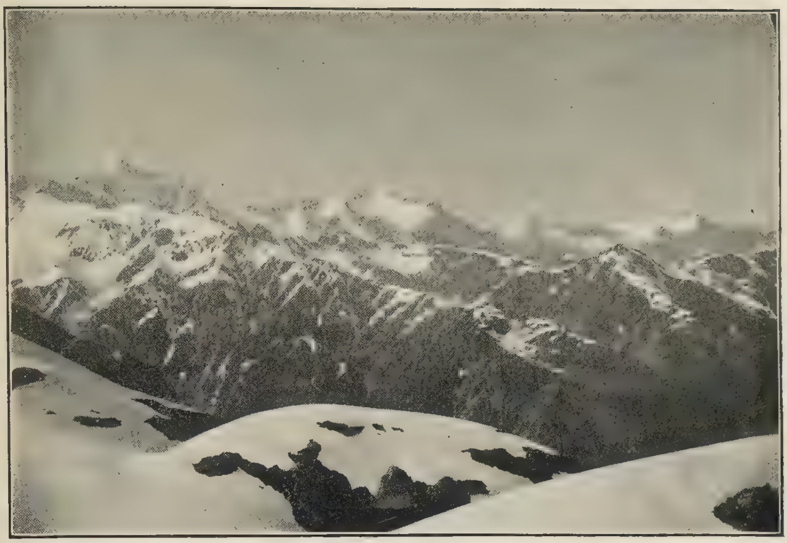


FIG. 1.—DISTANT VIEW OF MOUNT COOK, CANTERBURY, N. Z.

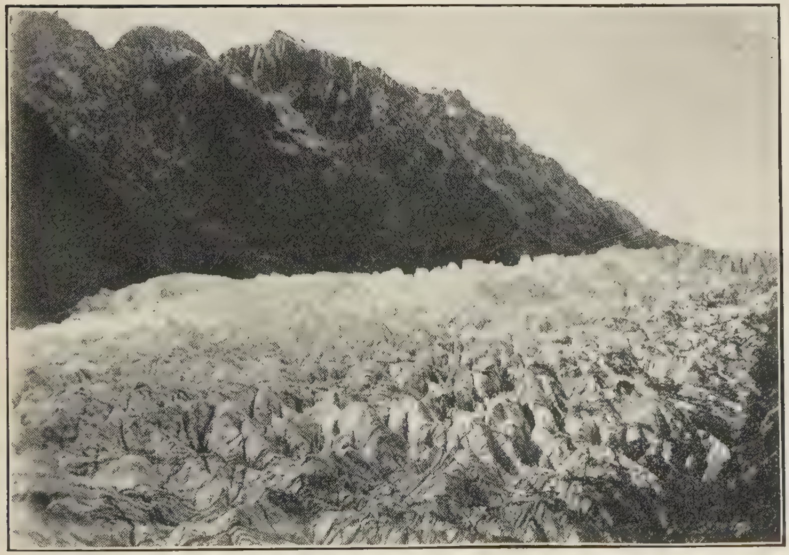


FIG. 2.—FOX GLACIER, WESTLAND, N. Z.

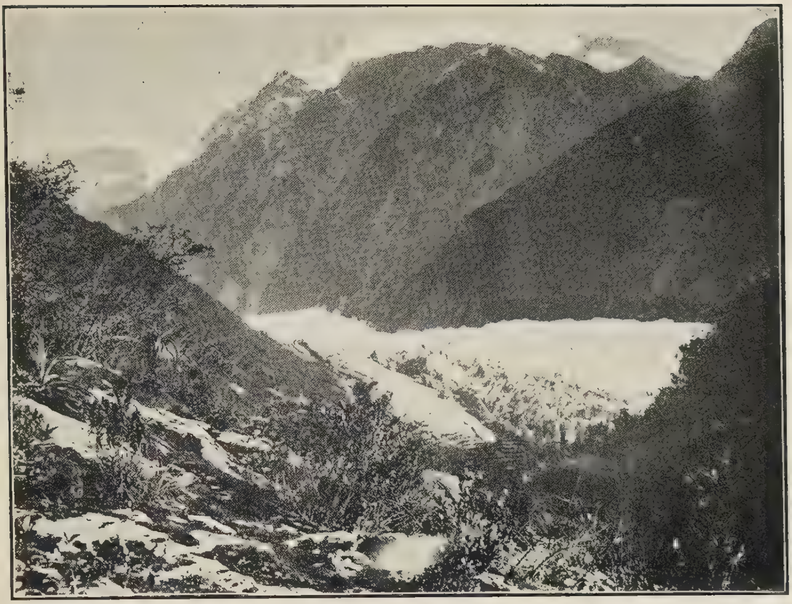


FIG. 3.—FRANZ JOSEF GLACIER, WESTLAND.

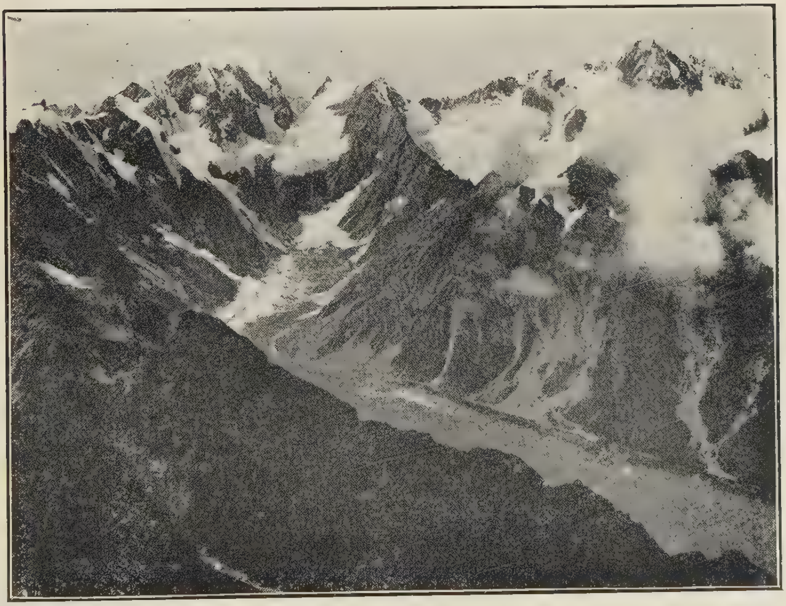


FIG. 4.—BALFOUR GLACIER, WESTLAND, N. Z.

New Zealand, flowing both to the Canterbury and the Westland sides of the Alps. North-eastward from Mount Harman the view discloses many lofty peaks, but, in general, there is a gradual diminution in height in this direction. Looking to the Canterbury side, one can see the mountains descend very abruptly at first, then more gradually for some miles, and finally disappear in the plains, at about 40 miles from the crest of the Alps. These plains, with remarkable evenness, continue to the seashore. The lower hills, lying just west of the plains, form the Foothills of the Alps. The wide, level stretch eastward to the sea is known as the Canterbury Plains. Towards the west the descent from the main crest of the Alps may be seen to be much steeper than on the eastern side, though at first it is less abrupt. On this side, also, parallel and branching ranges from the main ridge stand out less pronouncedly and are fewer in number than on the eastern side. Very little level land appears in Westland; but, bordering the sea, a narrow plain is visible, on which the town of Hokitika is situated. Towards the Alps this narrow plain is surmounted by many rounded hills, sometimes of sufficient altitude to be called mountains, which are outliers from the main ranges.

The fertile plains of Canterbury, almost devoid of timber, and easy of access, were settled in the early days of New Zealand colonization. The first settlement was made at Christchurch in 1848, and the settlers rapidly pushed westward, laying out farms and extensive sheep runs even on to the slopes of the Foothills. To-day the Canterbury Plains are dotted with splendid towns and villages and well-tilled farms. Roads run in every direction, and railroads connect the principal centres. For years after the settlement of New Zealand, Westland remained a wilderness. The dense forest which clothed the narrow plain did not tempt settlement from the sea-coast, and the Southern Alps formed an effective barrier from the east. It was only when alluvial gold-leads of astonishing richness were discovered near the mouth of the Hokitika River in 1865 that the first hardy pioneers found their way across the difficult mountain-passes and down the wild, rapid rivers to the Eldorado. Thousands of others came by sea. Mushroom towns grew up apace, and soon Hokitika had a population of nearly 20,000 people. All this transient glory has long since passed away, and Hokitika has faded into a broken-down town of some 2,000 inhabitants. Even yet there is comparatively little settlement on the West Coast, though the land is often rich, and it is only along the alluvial flats close to the principal rivers that one sees the scattered farms. The small community is an isolated one, the harbours on the sea-coast are poor, and there is only one main highway between the Canterbury Plains and the West Coast. This stage-road winds up the valley of the Waimakariri, and, crossing the Alps at Arthur's Pass, about ten miles north-east of Mount Harman, continues down along the broad valley of the Teremakau to the coast.

For years it has seemed to the Westland people that their dense forest has been the greatest drawback to their province, but in reality it is going to be one of their finest assets. Already timber is being exported. But it is not only in this direct way that the forest is to be of value. There is no doubt that the scenery of Westland is the most wonderful in New Zealand, and among the finest in the world, and the marvellous variety of the forest growth is its chief charm. It is this scenery which, by attracting thousands of tourists, will bring wealth to the West coast. The majestic *rimus, kahikateas,* and *totaras,* all giant conifers of magnificent shape; the beautiful dark-green, sweet-scented *rata,* covered with a moss of brilliant scarlet flowers for months in the year; the wonderful choice of ferns, from lacy filaments almost microscopic in size to huge tree-ferns towering 50 feet or more in height, with fronds even ten feet long; the stately cabbage-tree; the long-leafed nikau-palm; the innumerable pendent vines, creepers, and mosses; the brilliant Alpine flora—all these lend a fascination to the ever-changing forests of Westland which is quite lacking in the dreary, monotonous plains of Canterbury, and, owing to the marked difference of the flora of New Zealand from that of any other part of the world, give it a unique charm. The luxuriance of the vegetation is due to the mild, moist climate. The rainfall at Hokitika averages 120 inches a year; while it is only 25 inches at Christchurch, the lofty mountain-chain of the Alps precipitating the moisture brought by warm winds from the Tasman Sea, and thus preventing so large a rainfall on the Canterbury Plains. However, the actual number of rainy days at Hokitika is comparatively little more than at Christchurch, and no one can describe the brilliancy of the skies in Westland when the weather is fine; and weather of this sort, in which one can study the splendid sculpturing of the Alps, may last for weeks. The variety of the scenery is marvellous, and one is continually coming upon some new and charming feature—the deep gorges of the rivers; the innumerable splendid waterfalls, some of considerable volume, and many of tremendous height; the mountains with their tops capped with continual snow and ice; the great glaciers, stretching miles out from the mountains towards the sea: all these make

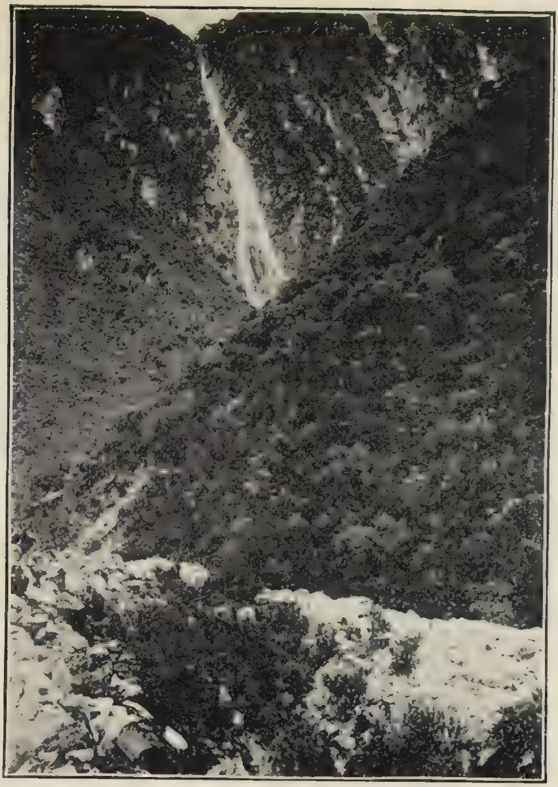


FIG. 5.—UNSER FRITZ FALL, NEAR FRANZ JOSEF GLACIER, WESTLAND.

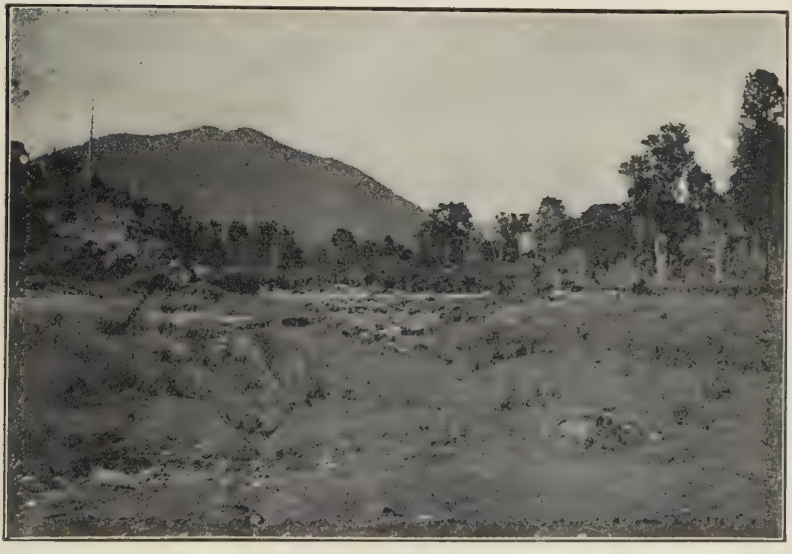


FIG. 6.—WESTLAND COASTAL PLAIN, SHOWING GRANITE OUTLIER.

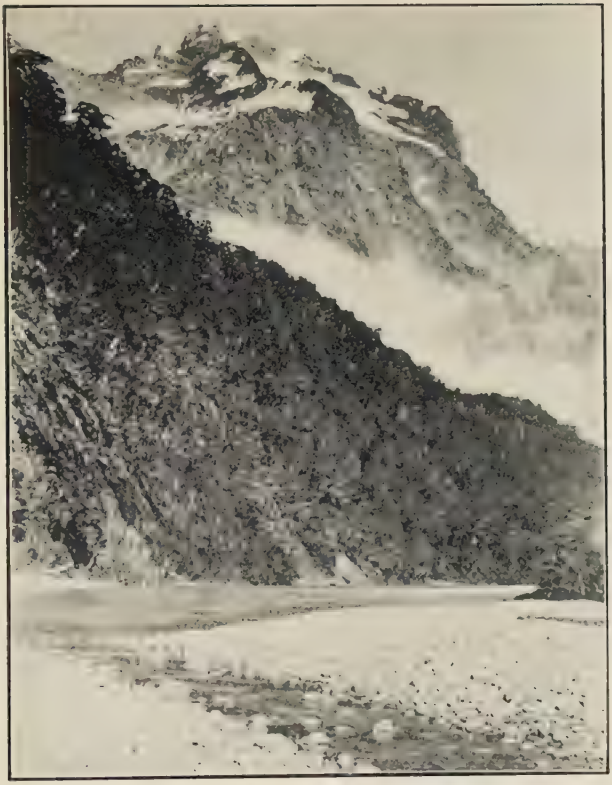


FIG. 7.—MOUNTAIN STREAM, WESTLAND.

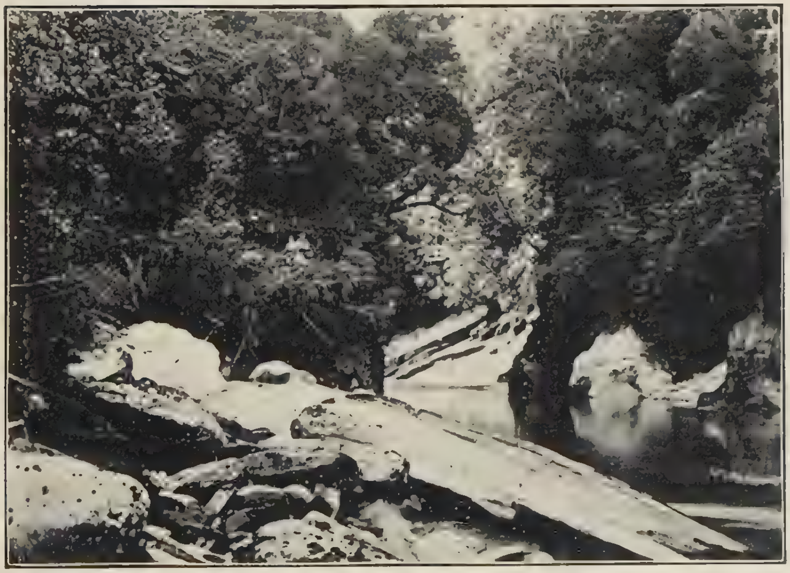


FIG. 8.—WESTLAND CREEK, N. Z.

an indescribably beautiful landscape set off in a wealth of marvellous foliage. From beneath the shade of immense tree-ferns one can look up on the mountains with their continuous white mantle and down into a broad valley filled by a glacier. One rather remarkable feature about the mountains of the West Coast is the lowness to which the snow-line descends. The line of constant snow is only about 6,000 feet above sea-level in the latitude of Hokitika, though it is higher on the Canterbury side. Yet snow falls only very rarely at Hokitika, while nearly every year an inch or more descends at Christchurch.

The geology of the region is simple. The *massif* of the Alps and of the Foothills consists, in the main, of greatly-altered Paleozoic sediments, with lesser amounts of Mesozoic, and possibly very early Tertiary sediments, and with minor intrusions of eruptive rocks of varying petrographical composition. The outliers on the western side of the mountains are Mount Tuhua, Mount Turiwhate, and the Hohonu Mountains, the remnants of an ancient granite range. The wide coastal plains on the Canterbury side and the narrow bench on the Westland side of the Alps are underlain by late Tertiary rocks, of gradual inclination towards the sea on either side. These strata are covered on the Canterbury side by glacial débris, and by immense thicknesses of gravels, thinnest at the mountain edge and increasing in thickness towards the sea. Near Christchurch, Banks Peninsula forms a decided break in the even coast-line. It is an area of rocks of volcanic origin, with characteristic well-formed craters, and other evidences of comparatively recent activity, though the exact age is unknown. The narrow plain of Westland is also covered by morainic material of heterogeneous character, and by fluviatile and lacustrine gravels.

The edge of the plains on the Canterbury side is about 1,000 feet above the sea. The plains commence among the Alpine foothills, as wide river flats, which, on leaving the higher ground, widen into fan-shaped deltas. The deltas of the various streams unite at the edge of the hills to form the relatively vast stretches of the Canterbury Plains. The plains are of a fairly-rolling surface, and have a gradual but steady slope towards the east, down which the rivers rush in ever-changing courses. The descent of the rivers averages quite 30 feet per mile near the Alps, though it is not so great towards the sea. Gorges with falls and rapids occur where the rivers, often rising in glaciers, dash from the mountains to the plains. These falls do not occur at the actual borders of the old Paleozoic land, since the narrow river flats which mark the commencement of the

Canterbury Plains are closely bordered by the mountains, and represent merely the more rapid erosion by fluviatile or glacial action than by sub-aerial decay. Along the various rivers wide, terraced flats show the successive levels of the streams in wearing down their channels to grade. Floods are of common occurrence on the lower river flats, especially towards the sea, and some serious inundations have destroyed great numbers of cattle and removed bodily many acres of very arable land.

On the Westland side the inner edge of the plain is also about 1,000 feet above sea-level, and hence its inclination to the sea is much more than that of the Canterbury Plains. The plain has been deeply scored by the glaciers which formerly flowed westward from the Alps; and though many of the glacial valleys were filled by morainic débris, the tremendous scouring of the many rivers is already rapidly wearing away the former plain, producing a new baselevel, above which the remnants of the former plain stand out with prominent relief. Still higher are the granite outliers of the old land, which were islands off the coast during the laying down of the late Tertiary sediments. Some of the larger streams, like the Teremakau, the Hokitika, and the Arahura, have wide stretches of river flats towards the sea. At the junction of the Hokitika and its two large tributaries—the Kokatahi and the Styx—the flat is approximately 10 miles across, and this towards the sea unites with the new coastal bench, several miles wide. Many relatively recent alterations in the drainage channels are very evident, though some of the rivers occupy ancient valleys. The Upper Teremakau probably flowed at some remote period east of the ancient granite range into the Arahura; later it flowed north by Lake Brunner. Its present channel is probably of recent formation, and thus the valley of the large and powerful Teremakau, though followed by a glacier in glacial times, is still comparatively narrow between the Turiwhate Range and the Hohonu Range. A small river known as the Orangipuku, which flows into Lake Brunner from the south, runs along the former channel of the Teremakau, and in one part of its course flows within 300 yards of the larger river, and practically on the same level. In addition, immense springs bubble up through the bouldery banks, along the Orangipuku, and their water evidently comes from the Teremakau, as the quantity which they put forth depends directly upon the amount of water in the Teremakau.

The lakes of Westland are very interesting, and show strikingly

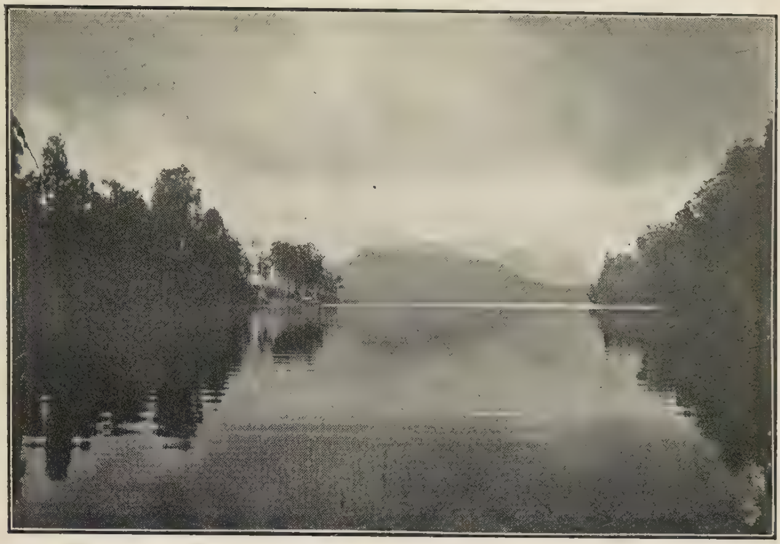


FIG. 9.—LAKE KANIERI, WESTLAND, N. Z.

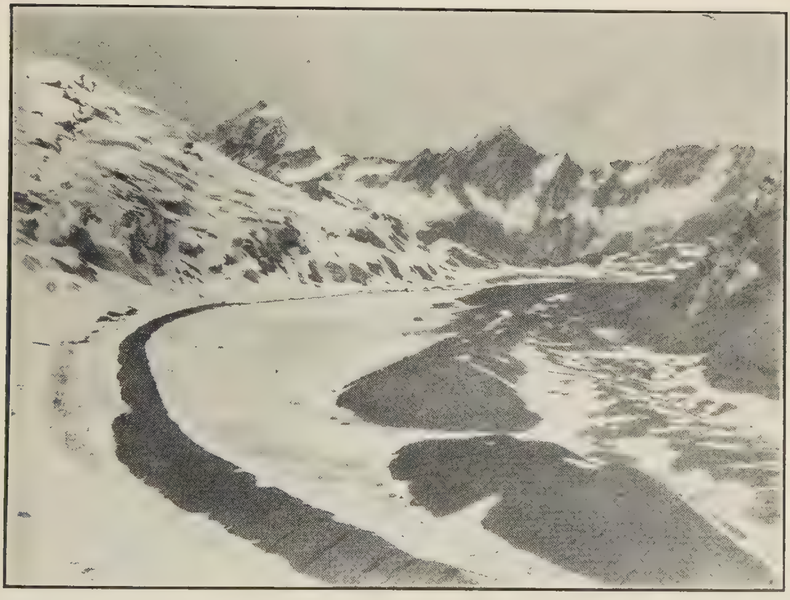


FIG. 10.—SOUTHERN ALPS, WESTLAND, SHOWING A MORAINE ON THE ICE, A VERY RARE FEATURE ON THE WESTLAND SIDE.

the pronounced influence of glaciation. Lake Kanieri is a beautiful sheet of water, with rough, rocky shores, bordered by a thick luxuriant foliage. The beauty of the lake is enhanced by the dark green of wooded hills, some thousands of feet in height, which immediately surround it, and by the magnificent snow-clad peaks of the Alps, which rise in stately splendour in the background. The basin of Lake Kanieri occupies an ancient river valley. During the period of maximum glaciation a glacier descended the Styx River and sought a passage northward through the valley now occupied by Lake Kanieri. Glaciers also flowed from the hills on the east and west of the lake. The effect of the union of the several glaciers has been the formation of a very deep trough, with a relatively even and almost level bottom. Soundings recently made by Mr. P. G. Morgan, of the Geological Survey of New Zealand, show that the greatest depth of the lake is 646 feet. As the surface of Kanieri Lake is some 422 feet above sea-level, the bottom is 224 feet below the surface of the ocean. The water of Lake Kanieri is dammed back by an immense terminal moraine at its northern end. Formerly this moraine turned the drainage in the opposite direction from that of the preglacial river, and the water sought exit by a channel flowing up the old valley into the present valley of the Styx. Then there came an immense slip from mountains to the east, which closed the passage to the Styx, and the lake sought exit over the lowest part of the moraine, or practically along the old Styx River valley. A lake of very similar origin to Lake Kanieri is Lake Coleridge in Canterbury, which drains to the Wilberforce. The lake occupies an ancient glacial valley, with its long axis parallel to the course of the Rakaia.

Lake Ellesmere on the Canterbury coast is quite different in origin from Lake Kanieri and Lake Coleridge. It is practically a shallow lagoon dammed off from the sea by a broad sand-bank. The lake was formerly a bay bordered on the north and north-east by Banks Peninsula, and the bank across its mouth has been produced by the sweep of the northward current which flows along the coast. The Totara Lagoon on the Westland coast is of similar origin, and Lake Mahinapua, which in time of flood receives the waters of the Hokitika River, is also to some extent the result of a current sweeping along the west coast, though in part it is dammed by morainic material. It is relatively a shallow lake, of dark-brown swampy water, of great scenic interest owing to the magnificent forest growth which surrounds it.

Browning's Pass is a broad U-shaped elevated trough, bordered by the rugged slopes of Mount Harman on the north and by the precipitous cliffs of Mount Hall on the south. Both are capped with perpetual snow, and from Mount Hall the Hall Glacier descends over an ice-fall into the huge cirque in which rises one of the tributaries of the Wilberforce River. Other tributary streams flow with steep falls from the slopes of Mount Harman into the cirque basin, which is some 1,600 feet below the level of Browning's Pass, or about 3,000 feet above sea-level.

Lake Browning on the summit of Browning's Pass, a somewhat shallow depression, a quarter of a mile in diameter, now forms the headwaters of the Arahura River, though it formerly drained over the lip of the pass into the Wilberforce. On the Arahura side, below Browning's Pass, is another great cirque, in which the Arahura receives several small tributaries, with steep, high falls from the surrounding mountains. One of its most interesting features is the low ridge, which borders it to the west, and through which the Arahura has cut a narrow gorge. Standing on the mountains on either side, one can easily trace the broad U-shaped valley on its course towards the sea, in which the narrow V-shaped valley is being incised.

Owing to the enormous rainfall on the West Coast, denudation is rapid. Immense rock-slides from the mountain sides continually descend into the rivers, and huge talus fans are rapidly filling up even the deepest lakes. The scenery of the Upper Arahura is magnificent in the extreme. From the summit of Styx Saddle, a grassy pass which leads from the Arahura to the Styx, one can look down on the broad, ancient glacial valley, wooded—the timber gradually disappearing upward and lost in scraggy ratas, mountain cabbage-trees, etc.—then above the snowgrass, and still higher the mantle of snow, from which protrude the dark-colored jagged *nunataks.* Away up the valley of the Arahura are the lofty giants of Mount Harman and Mount Hall, the jagged peaks covered with snow, and with here and there a flat, free from protruding rocks, indicating a small glacier. Down the valley one can see numerous falls leap hundreds of feet from wild, unexplored valleys, in magnificent cascades, into the main river.

Many years ago the Maori chiefs crossed the Alps at Browning's Pass, and descended their sacred river, the Arahura, in search of the precious greenstone (nephrite), from which their ornaments and war axes were made. Recently the discovery of auriferous quartz veins, on the western slopes of Mount Harman, has necessitated the construction of a rough mountain trail by the European inhabitants of New Zealand, over the same route followed so many generations ago by the Maori warriors.

James Mackintosh Bell,
Director of the Geological Survey of
New Zealand.

Wellington, 30th September, 1905.

MAPS OF MEXICO.

BY

F. J. H. MERRILL.

The person who, through scientific or commercial interest, seeks accurate cartographic information about Mexico,—or, indeed, accurate information about Mexican maps—meets with many difficulties. Libraries, as a rule, do not consider it important to keep in touch with the progress of maps and map-making; book-sellers handle only those maps which are made known by advertising and yield a liberal profit in handling, and commercial map-publishers can make a large profit from an untrained public by putting new dates on old map-plates. The inquirer, therefore, after wasting some time, ascertains that the preparation and publication of accurate maps has become a branch of Government work in Mexico, as in many other countries, and that information must be obtained from the Government Bureau in charge.

Our sister Republic, with its enormous extent of unsettled territory, is pushing to completion, as rapidly as possible, its topographic survey, which has been in progress more than twenty years, and will, in time, result in covering its territory with a series of sheets on the scale of 1:100,000, each including about 15′ of latitude and about 30′ of longitude.

As these will be, for a long time to come, the only accurate maps for the use of the public, a brief description will be of interest. The official key map shows the following divisions and prospective series: A. Nine sheets on the scale of 1:2,000,000, designated by large Arabic numerals. B. Twenty-four sheets on the scale 1:1,000,000, designated by small Arabic numerals from 1 to 24, beginning at the N. W. corner. C. Ninety-six sheets on the scale of 1:500,000, each of the sheets of series B being divided into four equal parts, designated by Roman numerals from I to IV. Of this series, about 20 sheets fall outside the boundaries of the Republic. D. Each sheet of series C is divided into 25 quadrangles on the scale of 1:100,000, designated by letters, and this base, with 50 meter contours, is the present base of general publication. On this scale 10 mm. = 1 kilometer or 1 mile = .633 inch.

The sheets measure 40 cm. x 53 cm., and are of uniform size for all the different scales. They are laid out in an arbitrary system of distribution, without especial reference to latitude or longitude, but with one sheet centring on the City of Mexico. The meridian of the east tower of the cathedral of the City of Mexico, which is 6 h., 36 m., 21.05 sec. West of Greenwich or in longitude 99° 5′ 15″ W., is the prime meridian of the Republic, and forms the centre line of one column of these sheets, so that east and west of the Mexico City sheet, known in the series as 19. I. M., the adjoining sheets begin approximately at long. 0° 15′ E. and 0° 15′ W., terminating approximately at long. 0° 45′ E., 0° 45′ W. respectively, including a rectangle 24.8 m. by 34.7 m. with an area of 860.6 sq. miles.

These maps are published and sold by the Seccion de Cartografía of the Ministerio de Fomento, in the City of Mexico, the price being 70 cts. Mexican per sheet. Up to January, 1906, 128 sheets had been issued, covering different parts of the Republic. Eleven of them are in Sonora, the others are mainly in a zone lying toward the Gulf of Mexico and extending from the Rio Grande to the Isthmus of Tehuantepec. They are well engraved and printed in three colours—culture in black, drainage in blue, and contours in brown. Their chief fault is the very large contour interval, 164 ft. For the mountain districts this is fairly satisfactory, but, in a relatively level country, it falls far short of meeting the public needs. It is also to be regretted that none of the contours are numbered as to altitude, and, further, that scales of English miles and Spanish leguas are not shown on these sheets; for they are used by many English-speaking people, who always estimate distance in miles, while the average native Mexican has no other measure of distance than the legua or league.

A matter of serious importance regarding the Mexican topographic sheets is the difficulty of obtaining information concerning them. The only New York library open to the public possessing a set is that of the American Geographical Society, and this was acquired by purchase. In the library of the U. S. Geological Survey are but 38 of the 128 sheets said to be issued. Few of the people who need to use them have ever heard of them, and lists of the maps already published cannot be had without writing to the office of publication.

With the growing investment of American capital in Mexico, and the increasing need for these maps by people who do not live there, it would seem that the Mexican Government should recognize the importance of placing sets of them in public libraries in the principal American cities, with full information concerning them. In this way the double purpose would be served of enabling many who need these maps to obtain them and of greatly increasing their sale. It is manifest to all who are familiar with commercial conditions in Mexico that these valuable sheets will not fulfil their utmost measure of usefulness if their sale is restricted to those persons who live near the City of Mexico. At Hermosillo, the capital of Sonora, the writer found it impracticable to obtain copies of these maps, although eleven sheets had been surveyed in Sonora and published.

Pending the completion of this topographic survey, a person requiring a map is much in need of general compilations of existing information. The Secretaría de Fomento issues from time to time editions of a general map of the Republic on the scale of 1 :2,000,000, or 31.6 m = 1 in., which probably express the best available information. One of these was issued in 1890 in the name of General Carlos Pacheco. It was engraved in Paris by Erhard Bros., showing surface configuration by hachures in brown, and is a very handsome map. A second was published in 1894 in the name of Manuel Fernandez Leal, compiled by Engineer I. Molina, and a third in 1899 under the same authorship. The last bears the imprint of LeCocq, Paris, and shows topography in a brown tint. It is a great advance over any previous issue, and is probably the best existing general map of Mexico. It has the specially good feature of showing in red all points located by their co-ordinates of latitude and longitude. It would appear from this that almost no work has been done in astronomical survey of the State boundaries, and therefore, their locations are, in most cases, probably not exact.

A point in which all Mexican maps which have come to the writer's notice seem to fail is in the accurate location of the mining camps, this being specially true of the topographic sheets. At the present time, when the development of many parts of the Republic is so largely dependent on the encouragement of the mining industry, it would appear that to locate these mines, or groups of mines, were a matter of urgent necessity. Surely the position of a mining camp producing thousands of dollars monthly is more important commercially than the location of some little village where practically no business is transacted, and of which the male inhabitants have no other means of livelihood than working in the mines a few miles distant. Yet this distinction is everywhere made.

No American maps of Mexico are wholly satisfactory. Probably the best is that compiled by M. Hendges and issued in 1900 by the Bureau of the American Republics at Washington, D. C. This shows with some accuracy the location of a considerable number of mining camps, in many cases indicating the character of their mineral product. Its scale is 1:3,168,000, or 50 miles to 1 inch, and its size is very convenient for a general map; but its usefulness is much impaired by a brown lithographic tint intended to show topographic relief. The purpose aimed at is not attained with any degree of accuracy, and legibility is much obscured by a lithographic error which has been made in printing the brown topography over the black culture and drainage, instead of the black over the brown, while the cost of manufacture is increased by an extra color. The details of drainage on this map differ considerably from those of the Leal map of 1899. It also makes the error of stating that the meridian of Mexico City is 99° 11′ 36″ W. of Greenwich, instead of 99° 05′ 15″. If the Hendges map were brought up to date and printed without the brown topographic tint it would be most satisfactory.

The other best-known American map is that of Rand & McNally. While of convenient size, on the scale of 72 m. = 1 inch, the base is obscured by an attempt to show mountain relief in black hachures, which interfere much with the legibility of the names and cannot by any possibility be correct. The interference is more evident on the folded maps, which are printed on uncoated paper, than in the atlases, which are on coated paper. This map without hachures would be much more valuable.

The experience of years of map-making by the best engravers of the world has established the fact that to show topography accurately by hachures involves not only accurate information, but very careful and expensive engraving. The work of the British Ordnance Survey and of our own Coast and Geodetic Survey is of the highest order in this respect. Where information is uncertain and economy is an object, attempts to show topography were better suppressed and the details of the map confined to drainage, the location of points of importance, and of lines of transportation, such as railroads, wagon roads, mule paths and canals. It should always be borne in mind that the frequent attempts to show topography by hachures in commercial maps are generally inaccurate and misleading.

The most perfect small-scale map of Mexico, showing by hachures the general features of its relief, is in Stieler's Handatlas, edition of 1904. The scale is 1:7,500,000, or about 118 m. to 1 inch; and as it can be bought separately at 20 cents a copy, it should be in the possession of every one interested in the topography of Mexico. Another topographic map of much interest is contained in a work entitled Le Mexique au Début du XXème Siècle, published by Ch. Delagrave, Paris, 1904. It is on the scale of 1:5,000,000, and shows relief in contours with an interval of 500 to 1,000 meters and with the successive zones in different shades of colour. This work contains, also, a small mineral map on the scale of 1:10,000,000, by A. de Launay, aiming to show by coloured conventions the location of the various mineral deposits. Its small scale, however, interferes somewhat with its usefulness.

Fairly accurate large-scale maps of the Mexican States are contained in an atlas compiled and published by Sr. Antonio García Cubas, Mexico, 1884. This work gives also a list of the mining camps in each State and considerable information concerning mineral resources.

There are probably numerous other maps of the various States, but only a few are known to the writer. A good map of Sonora is issued by C. E. Herbert, Nogales, Arizona; but does not include the results of the topographic survey.

Since the beginning of the present year, a new Map of Sonora and Baja California, on the scale 1:750,000 or about 12 miles to the inch, has been issued by Mr. Max Bohmer of Hermosillo. This Map has been compiled with much care and includes the data as to culture and drainage contained in the topographic sheets surveyed by the Mexican Government in Sonora. The boundaries of the various districts are shown with much greater accuracy than in any previous map, and considerable pains have been taken in locating the various Mining Camps. No attempt has been made to show mountain ranges by hachures, and so the reader is spared the bewilderment usually produced by the ordinary, necessarily inaccurate attempt in this direction. The map was made at Hamburg, Germany, at the Geographical Lithographic Establishment of J. Köhler. The clearness of its execution, the legibility of its lettering and the softness of its coloring leave nothing to be desired.

A fairly large map of Sinaloa was engraved by Edward Stanford, of London, and a very carefully-executed map of Sinaloa by F. G. Weidner, on the scale 1:1,500,000, showing mining camps and geology, is found in *Petermanns Mittheilungen,* Vol. XXX, p. 84.

Sr. García Cubas in 1882 issued a dictionary of geographic names, and a catalogue of places in Mexico, arranged alphabetically and giving the municipality, district, and State in which each place is situated, was published in 1898 by the Dirección General de Estadística of the Secretaría de Fomento. The Anuario de Estadística issued by the same department contains tables of astronomical positions and statistics of mineral production.

Geologic maps of Mexico are not numerous, and at present are not obtainable from official sources, though it is promised that a new one will soon appear with Bulletin 18 of the Instituto Geológico de México.

In 1899, Sr. Antonio del Castillo published a preliminary geologic map on the scale of 1 :3,000,000; in which year also appeared the second edition of his *Carta Minera,* which shows the mining camps of the several States on the scale of 1 :2,000,000. This map represents a vast amount of labour in compilation, and is doubtless as accurate as the state of information concerning the camps will permit, for only a few of them have been accurately located. A later geologic map on the scale of 1 :8,000,000 appeared in the Boletín del Instituto Geológico de Mexico, No. 6, published in 1897.

The Carta Minera of Sr. del Castillo has been in part replaced by the small-scale map of Sr. Luis Salazar in the Trans. Am. Inst. Mining Engineers, Vol. XXXII, p. 303. This map does not, however, reproduce all the camps located by del Castillo.

A general map of some interest is that entitled Carta de Comunicaciones de los Estados Unidos Mexicanos, on the scale of 1 :1,000,000, or 15.8 m. = 1 in., compiled by Colonel Bodo von Glümer and published in 1895-6 by the Secretaría de Estado. It corresponds to our U. S. post-route maps, and shows mail routes and telegraph and telephone lines.

A discussion of maps of Mexico would be incomplete without mention of the map of New Spain compiled by Humboldt in 1804 (published in 1812). It is on the scale of 56 miles to the inch, is well engraved, and shows the position of the mining camps with such accuracy as was possible and with a clearness which puts to shame all modern attempts of a similar character. This map is in the Atlas of New Spain, and may be seen in most of the larger public libraries.

In view of the necessarily slow progress of the topographic survey in covering the whole of the Mexican Republic, the writer would call attention to the fact that nearly every mining engineer residing in its territory could add to the sum of accurate geographic knowledge by determining the latitude and longitude of his camp. With the modern engineer's transit, latitude can be determined with an error not greater than 1′, or 6,000 ft. As a rule, camps are known as so many hours' ride in a certain direction, but their exact position is never determined.

RECENT ARCHÆOLOGICAL DISCOVERIES IN NORTH-WESTERN AMERICA.*

BY

HARLAN I. SMITH.

The explorations, of which a summary is now presented, were made in the village sites and graves of the southern interior of British Columbia and the interior of Washington; in the shell-heaps and cairns of the coast of Washington and British Columbia; and in the sites along the Columbia River between Portland and the coast.

It is found that the material culture of the prehistoric people was similar to that of the Indians now inhabiting the regions, and that the influence of one culture upon another was greater in earlier times.

The culture of interior southern British Columbia was found to be a unit; that of the coast constituted another unit, and in Central Washington was a culture differing in some respects from that of the interior of southern British Columbia and also unlike that of the coast. The remains in the Lillooet Valley showed influences of the coast as well as of the interior.

The southern interior of British Columbia is arid and the winters are cold. Vegetation is scanty, and, except on the highlands, there are few trees. The prehistoric inhabitants, like the Salish Indians to-day, relied upon many limited resources. They had the salmon from the rivers, besides the deer and the elk, which furnished food and clothing, with bones and antlers for tools and implements. The bark of the sage-brush supplied a fibre for cloth, and many domestic articles were made of stone.

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* The archæological investigations here described were undertaken in 1897–1899 for the Jesup North Pacific Expedition, and in 1903 for the American Museum of Natural History. The results of these expeditions are being published in the Memoirs of the American Museum of Natural History under the supervision of Dr. Franz Boas, who directed the whole work of the Jesup North Pacific Expedition. The specimens collected and the photographs taken are deposited in the Museum.

The age of the specimens secured is uncertain, but the absence of European objects in many of the places explored establishes the fact that the remains there found antedate the coming of white traders. Bows and arrows were used; the arrow-points usually chipped from stone, but also ground from slate, pieces of bone, or antler. Digging-stick handles, like those used by the present Indians, were fashioned out of antlers.

In preparing food, pestles and mortars of stone were used, and fish-knives made of slate. Mortars are scarce, but flat stones, which probably served the same purpose, are common. There is no pottery. Baskets or boxes, it is thought, were used for boiling food; the number of burnt and crackled stones found had probably served to heat water.

Circular holes from ten to thirty feet in diameter and two to five feet deep, enclosed by an embankment, indicate that the ancient houses were identical in type with those used in historic time. Two of these still exist, though fast going to ruin. Saucer-shaped depressions mark the sites of summer lodges, conical like those of to-day and the *tepees* of the plains, allying the culture of the region with that farther east.

Among the tools were wedges of elk antlers, stone hammers, adzes or chisels of nephrite, whetstones, carving-knives of beaver teeth, stone scrapers, and drills. Coarse sandstone semi-cylinders, grooved on the flat side and similar to the modern arrow-shaft smoother, were common. These are not found on the coast, and their presence strengthens the affiliation of the culture in this area with that of the plateaus and the east.

There were awls made of bone, skin-scrapers, some of stone like those used by the Shuswap and Thompson River Indians, others of bone; and flat needles of bone, such as are now made of iron and used for sewing cattail stalks into mats to cover the houses. A Shuswap woman was photographed in 1898 while dressing a skin with a chipped-stone scraper exactly like those found in the old sites.

War-clubs were found, one made of copper, others of whale-ribs, and some of these were carved with human heads in a style resembling that of the coast. There were also daggers of bone and of antler.

For dress the skins of deer and birds were used, as well as fabrics of sage-brush bark and other fibres. Head-scratchers, hair ornaments, nose-bars and ear-pendants, copper, bone, and shell beads, perforated teeth and claws of animals, were worn; and the body was decorated with red and yellow ochre and blue paint. Iridescent abalone shells and dentalium shells were imported from the coast.

For gambling the people had dice of woodchuck teeth, similar to those of beaver teeth still used by the Indians. Tubes were found, like the gambling implements of to-day, and perforated pecten shells such as are used for rattles in the dances of the coast people. The old pipes were made of steatite, shaped like a wine-glass and with incised designs. These pipes and the mortars are like those found as far south as California. The modern Indians occasionally used the tubular pipe, until quite lately.

The art of the people is best shown in the designs on a dagger, on digging-stick handles, dentalium shells and pipes. The circle-and-dot design is frequent here as well as to the south and west. The carving of the whale-rib war-clubs, that of a steatite pipe and some small figures in antler, are of a high order of merit, and must have been the work of a coast artist or of one familiar with that work. The modern Indians paint geometric and figure patterns in red ochre on the boulders; but their performance in this line, as well as in carving and technique, is inferior to that of the objects found in the old sites.

Graves were made in the sand along the streams and on the tops of the lower hills and terraces. They were solitary, or in groups. Graves under rock-slides occur in Nicola Valley. The body was laid on the ground and the rocks above were loosened so as to cause them to slide down and cover the body. In all the graves the bodies were flexed on the side; some were wrapped in cloths and covered with mats of rushes. With the dead were buried the articles used in daily life—arrow-points, celts, needles, beads, and other objects.

There is evidence of only one type and culture in this region. The modern Indians make their graves like the ancient; they know the use of the rock-slide burial, and they interpret the conventional marks found on the prehistoric remains; yet differences exist between the old and the new. The moderns make small arrow-points and believe the large points found in the excavations were made in a mythical period, and the modern pipe is a bowl or has an elbow-crook, like the type found on the plains.

The absence of pottery is characteristic of the whole north-west. Ethnological investigations have shown a connection of the recent culture of this area with that of the Rocky Mountain region.

On the whole, the prehistoric culture of the interior of British Columbia bears a greater affinity to that of the western plateaus than to that of the north Pacific coast. Both the physical type and the culture suggest that the peoples of the coast and those of the interior developed on distinct lines and that points of resemblance are due to contact, greater in the past than at present. In recent years the region seems to have taken elements from the east.

The coast of British Columbia and Washington has a moist climate. Very warm or very cold weather is unknown, and the vegetation is luxuriant.

The tribes of the coast make ocean-going canoes of single cedar-trees and build large houses of the same wood, which is also made into implements and utensils; and the bark supplies garments, bags, mats, and the like. Their villages border and face the sea, which is their highway, and provides their staple food, the salmon and shellfish and the seal.

The shell-heaps of refuse from the ancient houses mark the sites of the villages. More than a hundred and fifty of these were noted in a region of less than 1,000 square miles on the north end of Vancouver Island and the opposite mainland. They were generally at the mouths of fresh-water streams, and several hundred yards long by five or six feet high, while a few were miles in length, with a maximum height of over nine feet. These heaps are of great age. The stump of a Douglas fir tree, more than six feet in diameter, stood on one heap, with layers over eight feet in depth, in which were found artifacts and human remains. An ordinary stump on this heap showed four hundred annual rings within its burned periphery, and the circumference of another stump exceeded twenty-eight feet. This indicates an age for the top layers of more than five hundred years, and a greater age for the bottom layers.

The shell-heap at Port Hammond, in the upper Fraser delta, is twenty miles by water from the present seashore, and by land the nearest point of shore is over ten miles away. The modern Indians use the water route, and prefer to live near the shell-beds. It is hard to believe that they would carry shellfish from the present seashore to the heaps at Port Hammond. The time required for building the delta into the sea may furnish a basis for estimating the age of the Port Hammond heaps. These consist almost exclusively of clam and mussel shells, generally with very few artifacts; but in the heaps of the Fraser delta artifacts and human remains are often found.

If the early people, like the Indians of to-day, used tools and implements of cedar, this would explain the scarcity of archæological specimens in the shell-heaps of the sea beaches.

Besides the points used for fish-hooks and harpoons, net-sinkers of perforated pebbles were found, with fish-knives of slate, pestles, and mortars.

House sites are sometimes indicated in the more modern heaps by an embankment enclosing a rectangular level space. These suggest that the old houses were of great size and made of planks, like the present dwellings of the Indians. Large houses would be needed in this region of continued rains. In building, wedges and other tools of cedar were probably used, besides those made of antler and stone. At Fort Rupert, in 1898, we photographed a Kwakiutl Indian who was sharpening a stone adze like those found in the shell-heaps. The stone pestles were no doubt used as hammers in carpentry, as they are by the Indians to-day. Mats of cedar bark are used like tapestry by the modern Indians to shut out the wind from their houses; and the earlier people probably did the same.

Numerous pebbles with battered ends were found, such as are still used in a game resembling quoits. A few short tubular pipes were found.

The art of objects found in the lowest layers of the shell-heaps seems to be better than that of the modern work. A small carved mask of soft coal is particularly remarkable. Incised geometric designs were found.

Pecked petroglyphs of realistic character were seen near Nanaimo. Purely pictographic art is not found, and the circle-and-dot design, common among living Indians, is wanting on archæological specimens. Articles of use were decorated with sculptured animal forms. The realistic art, as a rule, is cruder than that of the north, and resembles that of the Lillooet Valley near-by, and perhaps that of the region between the lower Fraser River and as far south as the Dalles. It bears a likeness to some of the old carvings of the interior.

Shell-heaps, cairns, and mounds cover the graves, and artifacts are not found in these graves.

The burial-mounds of the region present similarities of structure with the cairns; and one may be derived from the other.

Skeletons are rarely found in the shell-heaps, except in the deltas of the Fraser, Stillaguamish, and Skagit Rivers. In the Fraser delta they were usually found in the rear portion of the heap, with numerous unbroken strata above them. Two distinct types are represented in the remains, apparently co-existent, since they are found in the same layers. If tree-burial prevailed in former times as at present, it would account for the scarcity of human remains in the shell-heaps of the coast.

The objects found in the heaps of the lower Fraser River are more numerous and of higher artistic value than in those of the coast or the other deltas. The difference in chaarcter between the shell-heaps of the deltas and the coast seems to be due to conditions of soil and modes of life.

The prehistoric people lived in many respects like the present natives of the Fraser delta. They depended largely upon shell fish; fished, and used retrieving harpoons for large sea-mammals; and they hunted the mountain goat, the deer, and the elk. They made garments of skins, and they were workers in wood. Physically, they were of two types, which Prof. Franz Boas describes as follows:

> The one type is characterized by a narrow head, the narrowness of which was emphasized by lateral pressure, with a marked median ridge on the forehead, narrow and high nose and rather narrow face; the other by a wide head (produced partly by antero-posterior pressure) and a wide face.

The natives of the British Columbia coast probably did not chip stones. The chipped points frequently found on Fraser River and at Saanich resemble those of the Thompson River region. Those of Puget Sound and the coast of Washington are more like the chipped points of Columbia River. Some objects frequently found in the interior are not met with in the shell-mounds of Fraser River. Neither chipped stone drills, nor knives, nor sandstone half-cylinders, nor dice of teeth, were found; and there were no objects buried with the dead. The similarity of culture of the prehistoric people in the Fraser River delta and in Saanich coincides with the distribution of languages at the present day. The Salish languages reach the Gulf of Georgia and southward to Shoalwater Bay. In the same latitude the same dialect is spoken east and west of the Gulf of Georgia. Vancouver Island and the opposite mainland must, therefore, have had a common history. It is probable that an early migration from the interior carried the art of stone chipping, the decorative art, and the pipes to the coast. Here it should be noted that the highest type of art on the Northwest Coast never extended south of Comox, and never reached the west coast of Vancouver.

A few specimens point to similarity between the prehistoric people of the Fraser delta and those of the north. The most striking is the labret, which in historic time was not found south of Milbank Sound.

One result of the migration referred to may have been the modification of burial customs in the southeast of Vancouver Island. The earliest-known form of burial, long antedating contact with the whites, was in stone cairns. Later, the bodies were put in wooden chests, which were placed on the ground, or in trees, in caves, or on little islands. Sometimes a canoe was used for a chest.

On the whole, it may be said that the culture of the ancient people of the shell-heaps was in essential particulars similar to that of the tribes now inhabiting the same area, though it was more strongly influenced from the interior. To follow the course of its development it will be necessary to search out older deposits.

Central Washington is arid, with a climate resembling that of the southern interior of British Columbia, though warmer in summer and colder in winter. There is less vegetation, and, except in the river bottoms and in irrigated districts, there are no trees.

The number of tribes was great, and this suggests that more than one area of culture may have existed in the region. A definite age cannot be assigned to the articles found.

The implements used in procuring food include chipped projectile points, but rubbed points were rare. There were some digging-stick handles. There were many net-sinkers of notched and grooved pebbles, rare in the north and not common on the coast, except at the mouth of the Columbia River. Some pestles used were unusually long, and some had tops representing animals' heads.

Sites of ancient semi-underground houses were seen, with stones on top of the embankment; and there were circles of stones, which may mark lodge sites. The modern Indian lodge is identical in shape with that found in the north. Arrow-shaft smoothers were seen, besides tubular pipes, and one consisting simply of a bowl.

An antler carving of a human figure showed the ancient form of dress; a feather headdress, like that seen to-day as far east as the Dakotas, the hair ornamented with dentalium shells, the body painted and wearing a fringed apron around the loins. This object was found in the grave of a little child. It was of good technique.

The circle-and-dot design was common. Pictographic paintings in red and white were seen.

There were three methods of burial. In the stretches of country locally known as *scab-land* there occur groups of low, dome-shaped knolls, consisting of fine volcanic ash, left, as it seems, by the wind. The prehistoric Indians used many of the knolls, each for a single grave. In one grave was found a cyst of thin slabs of basalt. Dentalium shells were found in the grave and the body was flexed on the side.

Rock-slides had been used as burial-places, as in the north. Rings of stones were seen, and excavation within these brought to light the cremated remains of several bodies with shell-beads and ornaments.

Evidences of the close communication of these people with the tribes of the southern interior of British Columbia are: preponderance of chipped over ground points, digging-stick handles, sites of semi-underground houses, pestles with animal-head tops, arrow-shaft smoothers, tubular pipes, the circle-and-dot decoration, engraved dentalium shells, rock-slide sepulchres, and the burying of articles with the dead; all common to both regions.

Certain pestles and clubs of stone differed from those found in British Columbia, and chipped implements were made of a greater variety of stone and more were of beautifully-colored materials. Notched and grooved sinkers were much more common, and sap-scrapers were not found.

Material of the same art as that found in the Dalles region was seen. The people of the Yakima Valley clearly had dealings with the tribes as far north as the Thompson Valley and southward to the Dalles of the Columbia. The present Indians, it may be noted, travel more widely than would be necessary to distribute their artifacts thus far.

Very little evidence of contact between the people of the coast and those of the Yakima Valley was discovered. Many of the stone pestles and clubs were different from those of the coast, but sea-shells of several species were seen, and a pipe, clearly of north-west coast art, was found far up the Toppenish River, a western tributary of the Yakima.

The culture of the prehistoric people resembled that of the present natives, and differed greatly from the ancient and modern culture of the coast to the west, and somewhat from that of the southern interior of British Columbia to the north.

In general, the culture of the North Pacific coast does not extend far inland. Northward its limits are unknown, but southward it coalesces with that from the Columbia River in the region between Seattle and Shoalwater Bay. In the interior we have a plateau culture differing somewhat at the north from that at the south. Several small culture areas lie adjacent to these. Each culture appears to have developed independently, but to have been influenced by one or more of the others.

Experience shows the advisability of conducting archæological work in co-operation with students of living tribes. A study of the Indian living in the country under exploration usually throws light on archæological finds made there, while an understanding of the antiquities of a region helps the study of the Indian living there. The continuity of the historical problem is met by a continuity of method.

In selecting fields of operation it seems best always to continue explorations in an area so far distant from one already examined that new conditions will be encountered. This will make it probable that new facts will be discovered, if not a new culture area. At the same time the new field should be so near to the old that no culture area may intervene. Thus the culture boundaries may be determined, and new areas discovered. Exploration carried on by this continuous method makes the experience already gained of service in a new and adjacent field, while discoveries in such a new field may lead to a better understanding of those previously examined.

It remains to determine the northern, eastern, and southern limits of the general plateau culture, how far it may be subdivided into local areas, and the inter-relation of these with each other and with outside areas.

Specimens are few from the whole region lying between the mouth of the Columbia, the Santa Barbara Islands, the Cliff and Pueblo region of Arizona and New Mexico, and the Mound region of the Mississippi Valley. Literature on the archæology is scanty. That whole region north to the Arctic and all that of the plains towards the east and south throughout the plateaus and Nevada remain to be explored.

THE ERUPTION OF VESUVIUS.

The activity of Vesuvius since last February culminated early in April in an outburst that will rank among the historic eruptions. An account of the occurrence in the Bulletin will be deferred until it can be treated more accurately and adequately than at present; but some facts of interest from the press reports may be given.

April 5.—The volcano became strongly active, and large masses of rock were hurled as far as the lower station of the funicular railway.

April 6.—The lava-flow arrived within three or four miles of Bosco-Tre-Case, on the southern slope of the mountain; another stream threatened Ottajano, on the north-eastern slope. A new crater was formed.

April 7.—Bosco-Tre-Case, between the volcano and Pompeii, was buried under lava, which swept down in a torrent from the new Ciaramella crater. There were two streams from this crater, one of which, 600 feet wide, moved towards the centre of the town, which had been abandoned by its inhabitants. The town was completely surrounded by lava at 6 A. M. The south side of the cone of Vesuvius collapsed. Another new crater opened on the north side of the cone in the Atrio del Cavallo, and ejected large quantities of lava and stones. The old crater, also, was in violent eruption. Gray volcanic ash fell in the streets of Naples, and explosions were incessant.

April 8.—Dr. Matteucci, the director of the Royal Vesuvian Observatory, reported:

> The eruption of Vesuvius has assumed extraordinary proportions. Yesterday and last night the activity of the crater was terrific and ever-increasing. The neighborhood of the Observatory is completely covered with lava. Incandescent rocks are thrown by the thousand to a height of 2,400 and 3,000 feet, and fall back, forming a large cone.
>
> Another stream of lava has appeared from a fissure, the position of which is not well defined. The noise of the explosions and the rocks striking together is deafening. The ground is shaken by strong and continuous seismic movements. The instruments threaten to break. It will probably be necessary to abandon the Observatory, which is very much exposed to electric shocks. The telegraph is interrupted.

A telegram from Naples announced that Ottajano, Poggio Marino, and Somma had been abandoned. The lava was flowing seven feet deep through the streets of Ottajano. A telegram from Montenegro said that a shower of black dust, like iron filings, supposed to come from Vesuvius, fell throughout that country, covering the surface to a depth of a millimeter with an iron-gray deposit.

April 9.—The lava-stream that had been moving towards Torre-dell' Annunziata stopped flowing, and the eruptions were less violent. Clouds of volcanic ash still filled the air, making the day so dark that navigation was dangerous in the Bay of Naples. The seismic instruments on previous nights recorded several earthquake shocks. The dynamic action of the volcano appeared to be considerably diminished. Professor Matteucci reported at 6.30 P. M. from the Observatory:

> The explosive activity of Vesuvius, which was very great yesterday and was accompanied by very powerful electric discharges, diminished yesterday evening. During the night the expulsion of rocks ceased, but the emission of sand increased, completely enveloping me and forming a bed more than ten centimeters deep, which carried desolation into this elevated region. Masses of sand gliding along the

earth created complete darkness until 7 o'clock.* Several blocks of stone broke windows of the Observatory. Last night the earthquake shocks were stronger and more frequent than yesterday, and displaced the seismic apparatus. Yesterday afternoon and this morning torrents of sand fell. While I am telegraphing several balls of fire rise with loud rumbling from the enlarged craters and the new elevated crevasses.

April 10.—Professor Matteucci reported from the Observatory:

Last night was calm except for a few explosions of considerable force from time to time. At 4 o'clock this morning the explosions became more violent. The seismic instruments of the Observatory record strong disturbances in the interior of the mountain.

April 11.—Vesuvius became comparatively quiet.

CHANGES ON THE EARTH'S SURFACE.

Studies of the surface of the earth have never been so numerous or so varied as at present. There are still many gaps unfilled, however, and Richard Tronnier, head-master at Hamm, Westphalia, has called attention to some of them (*Pet. Mitteil.,* No. 2, 1906). While the atmosphere and the hydrosphere, on account of their circulation and large practical interest, have had the lion's share of attention, there are phases of the phenomena of the earth's crust which are only beginning to receive due investigation. Periodicals devoted to seismology, for example, are of recent establishment. In addition to the study of tectonic changes, to which great attention has been given, investigators have been chiefly concerned in such modifications of the earth's surface as are made by the changing boundaries between land and sea, the growth of deltas, the spreading boundaries of cities, etc.

Tronnier believes it is highly important that systematic efforts should be set on foot to collect in a systematic manner the facts concerning the changes of the earth's surface constantly going on before our eyes, and he thinks that these data, scientifically collected and arranged, would form an important document in the history of our planet. He presents a considerable number of occurrences reported last year as illustrations of the work which, he suggests, should be done. A number of them may be referred to:

The steamer *City of Panama* reported in January that in 16° 15′ N. and 100° 29′ W. she had passed through an area, a mile wide, that was so thickly covered with trees, plants and the bodies of animals that she could hardly force her way. It has been suggested that this phenomenon may have been caused by the destruction of one or more of the islands of the uninhabited Revilla Gigedo group.

The island Nushima was seen by the natives of some of the Bonin Islands to rise above the surface of the Pacific on Nov. 14, 1904. It finally attained a height of 480 feet. It was found in July, 1905, that the island had gradually become reduced in size until its highest point was only 10 feet above the sea and its periphery had greatly decreased. It was thought that in a few weeks more it would entirely disappear.

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* The language is dark, like the sand.

The island Milli, in the Pacific, was almost entirely destroyed by the assaults of winds and waves, only a wretched sand-waste remaining.

The Portuguese fishing-port and watering-place Espinho became, to a large extent, the prey of great sea waves that kept eating away the banks and undermining houses, and, at the end of January, the destruction was augmented by a hurricane that destroyed 81 houses. It was believed that the existence of the entire town was threatened.

Early in the year a strip of coast near Dover, England, fell into the sea. The area of rock was estimated to weigh 250,000 tons. It was the largest rock-slide on that coast in a half century.

Fifty-eight persons were killed by a landslide from a mountain overlooking Lake Loen in Norway, the displaced waters overwhelming a town on the opposite shore and carrying a small steamer 300 meters inland.

On Nov. 5, about 15 acres of land on the edge of Moen Island slipped into the Baltic Sea. The land, with the forest that partly covered it, was valued at 10,000 crowns.

The Rio Grande changed its course for a distance of several miles, placing the United States town La Mesa on the Mexican side of the river.

The Spitzberg, a small eminence near Krielow, Prussia, often climbed by tourists for the fine view it afforded of the Havel valley, was entirely removed by a railroad company.

These examples include changes wrought by the sea on islands and coasts, by rock-slides and flowing water on the land, and by human agency on a feature of the topography.

The single-handed observer can do little of permanent value in the collation of accurate data relating to such occurrences as these; but there is a great opportunity for the organization of systematic work in this new field.

Dr. Supan, commenting upon the suggestion offered by Mr. Tronnier, says that it should be favourably received, that it is well worth the attention of the next International Geographical Congress at Geneva, and that it is to be hoped that the difficult question of the organization of such observations, to be carried on all over the world, will, at least, make important progress towards solution at that meeting.

LAST YEAR'S WORK OF THE MICHIGAN GEOLOGICAL SURVEY.

During the summer of 1905 joint topographic work was continued in connection with the U. S. Geological Survey, first around Marquette, under J. M. Whitman. Here the work proved to be of unexpected difficulty and complexity; but it is hoped that the resultant map will be of a high degree of accuracy and interest. In the Lower Peninsula the topographic work now completed includes not only the Ann Arbor quadrangle, but a strip east of the international boundary, and most of this is either published or will be in a few weeks. The work is now being extended northward around Pontiac. A detailed map of the Black River from Bessemer north to Lake Superior has been prepared by W. C. Gordon to illustrate the cross-section of the copper-bearing rocks (and, in fact, from the Laurentian granite) to the lake.

Last summer Prof. I. C. Russell, of Ann Arbor, continued his studies of the surface geology of the Upper Peninsula westward from the Menominee and Crystal Falls districts in a harmonious scheme of work with Mr. Frank Leverett of the U. S. Geological Survey, who covered the eastern end of the Upper Peninsula studying the hydrography and surface and glacial geology, and they were assisted by Mr. W. C. Gordon, Prof. C. A. Davis, and Mr. G. L. Tower on behalf of the State Survey.

Dr. Alfred C. Lane, the State Geologist, was largely employed in the copper country studying diamond-drill cores and other recent developments in the copper district. In the lower parts of the State Mr. W. F. Cooper was completing his report on Bay County and assisting Prof. W. H. Sherzer in his report on Wayne County. Prof. C. A. Davis is making a monographic study of peat. He has also nearing completion a report on Tuscola County, a contour map of which appeared as Plate IV of the annual for 1903.

The following counties have therefore been covered: by State Survey contour maps, Huron, Tuscola, Sanilac, Bay, Kent, Monroe, and parts of Arenac and Iosco; by the United States Survey, the Marquette range in Marquette County, the Menominee range in Menominee and Dickinson Counties, the Gogebic range in Gogebic County, and a good part of Iron County. By the co-operative Survey, Wayne County, most of Washtenaw County, and parts of Monroe, Lenawee, Macomb, Oakland, and Livingston Counties, and the neighbourhood of Marquette in Marquette County.

The annual reports of the Board of Geological Survey of Michigan for 1903 and 1904 were issued last year. The 1903 report contains contour maps as follows:

One of Bay County, prepared by W. F. Cooper, whose report on that county is now waiting publication. This county is, in general, very flat, and requires and has been covered by a large series of survey drains, and this map, which is based upon these drain levels, railroad levels, lines of levels for macadamized roads, and a few other lines of levels especially run, is therefore in considerable detail, the contour interval being five feet. It also shows areas of former and present flowing wells;

One of Tuscola County, prepared by Prof. C. A. Davis. A contour map of the Ann Arbor quadrangle from latitude 42° to 42° 30′ N., and longitude 83° 30′ to 84° W., which shows not only the contours but the wooded areas, in a part of the State which may be considered as thoroughly settled. This survey was made by the U. S. Geological Survey in co-operation.

The report also contains papers on the water supply of the Upper and Lower peninsulas, with maps, and a special paper by B. E. Livingston on the relation of the soils to the natural vegetation in Roscommon and Crawford Counties, with a map. Other more geological subjects treated are limestone, building-stone, road materials, transmission of heat into the earth, the grain of rock, the theory of copper deposition, and the Keweenawan lodes. All these papers have special reference to conditions in the copper country.

There is also a note on recent shore-formations by W. M. Gregory, which gives interesting data regarding the growth of Tawas Point, a cuspate foreland north of Saginaw Bay, which has been growing at the rate of something like 60,000 square feet a year.

The annual report for 1904 contains a paper published with the permission of the U. S. Geological Survey on the Failure of Wells along the Lower Huron River, in 1904, which failure was locally attributed to a deep well. Mr. Fuller, the author, however, attributes the failure mainly to deficient rainfall and extensive ditch-draining to lower the ground water-level at the point of the intake.

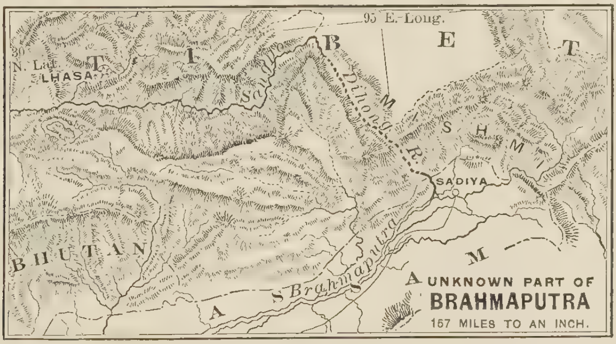
The most extensive part of this report is an article by Prof. I. C. Russell on the conditions along the north shores of Lakes Huron and Michigan, with numerous illustrations, including eskers and drumlins, cut terraces and cliffs, sand dunes and gravel bars. Prof. Russell's theory of the origin of certain drumlins, that they are carved out of a sheet of clay trended from the northwest by ice moving later in a different direction, is of general interest. This theory is applied especially to the drumlins around Menominee. Another area which is beautifully marked in the mapping is that of the Les Chenaux Islands, east of Mackinaw, the pronounced trend of which is determined by the axes of the drumlins.

The personal report of the State Geologist contains various economic notes; the report of the joint committee on the stratigraphy of the Lake Superior region, with some personal comments on the same and some notes on the grain, and also an excellent colored plate showing the increasing coarseness of the grain as it occurs in certain diamond-drill cores in the copper-bearing formation. An interesting general conclusion from the studies of grain is that in case of the much-discussed Laurentian gneisses the intrusive gneisses were considerably superfused, while the rocks into which they were intruded were almost reliquified. Some notes are also given on the prospects of Lake Superior gold mining, and oil and gas.

PROPOSED EXPLORATION OF THE BRAHMAPUTRA.

The London *Times* (weekly edition, April 13) says that a resolution has been adopted by the Council of the Royal Scottish Geographical Society and ordered to be submitted to the Secretary of State for India in Council. It is to the effect that, in view of the great regret felt in geographical circles throughout the world that the proposed expedition down the Brahmaputra to Assam did not take place at the close of the Tibet Mission, 1903-1904, the Council trust that the Indian Government will now see their way to carry out this exploration, which is of extreme interest and importance, on the following grounds:

By it would be finally settled the question of the connection of the Sangpo of Tibet with the Dibong (Brahmaputra) of Assam.



The known difference of levels renders it certain that the river must descend from Tibet to the plains of India by great waterfalls exceeding all others in height and volume. If these falls (which are said by the Tibetans to exist) should be discovered, much light would be thrown on the geology of the region. In particular we might expect information as to the structure of the country traversed, and the relation borne by the vast Himalaya ranges to the elevated plateau against which they abut.

Nothing is known at present of the tribes who inhabit the tract through which this part of the river passes. Valuable collections of the fauna and flora would probably be obtained. It is possible that a good route might be discovered leading from Assam into Tibet by the great river; such a route would have much importance in promoting British trade with Tibet. The resolution is signed by the president, Professor James Geikie.

This part of the course of the Brahmaputra has not been surveyed on account of the hostility of the Mishmi tribes among the mountains. No exploring party has been sufficiently strong to push through this inhospitable country.

GEOGRAPHICAL RECORD.

AFRICA.

THE DUKE OF THE ABRUZZI STARTS FOR AFRICA.—The expedition of the Duke of the Abruzzi to Mount Ruwenzori sailed on April 17. Twelve Europeans are in the party: the Duke of the Abruzzi, Captain Cagni, Dr. Cavalli, Lieut. Winspeare, Dr. Roncati, a geologist, Signor Vittorio Sella, two Alpine guides, two porters, and an assistant photographer.

THE FRENCH CONGO.—A decree issued on Feb. 11, 1906, modifies the territorial divisions of the French Congo (BULLETIN No. 3, 1904, p. 169). The region is divided into four districts—Gabon, Moyen-Congo, Oubangui-Chari, and Tchad—all of which will be under the administrative control of the Commissioner-General residing at Brazzaville. The first three are colonies with financial and administrative autonomy, while the Tchad district is a military territory attached to the Oubangui-Chari. The capitals of the colonies are Libreville, Brazzaville, and Fort de Possel.

The territorial modifications do not greatly affect the division of the area made in 1894, but the Gabun receives some accession of territory by the incorporation of coast districts formerly included in the middle Congo. The Gabun colony now comprises all the basin of the Ogowe, with coast districts from the Spanish territory in the north to Sette Cama in the south. The Chad territory includes practically all the French portion of the Shari basin, together with Wadai and Kanem.

Commissioner-General Gentil has returned to the Congo to carry out the programme of administration formulated by the Colonial Minister. It is designed to guard the natives against ill-treatment, preserve the resources of the country, and rationally develop them.

THE NILE FLOOD AND ITS VARIATION.—Captain H. G. Lyons, Director-General of the Survey Department of Egypt, has been making a study of the Nile floods in relation to pressure conditions and rainfall (see this BULLETIN, Oct., 1905, pp. 601-602). His latest paper is entitled "On the Nile Flood and its Variation" (*Geographical Journal,* Sept.-Oct., 1905), and concerns the possible correlations between Nile floods and other periodic oscillations in solar and meteorological phenomena. Several writers on the Nile have asserted that an alternation of high and low floods is evident, and have sought a relation between this alternation, on the one hand, and sun-spots (Fritz), deficient monsoons in India (Willcocks), solar weather (Lockyer), and Indian pressures and monsoon characteristics

(Eliot), on the other. Captain Lyons has undertaken to determine whether there is a periodical variation in the Nile flood, whether a series of good floods is regularly followed by one of deficient floods, or whether excess and deficiency succeed one another irregularly. The Nile flood represents the run-off of an area over which the East African monsoon rains fall in June, July, August, and September. Hence the variation of this rainfall is the real thing to be studied. The flood is practically independent of the White Nile, and for this reason no attention need be paid to the meteorological conditions and rainfall in that basin for the purposes of the discussion.

Fairly reliable records of the maximum readings of the Nile floods are available for eighty years past, and there does not appear to be any definite relation between the sun-spot curve and either the five-year or the yearly flood-curve. Hence the Abyssinian rainfall, upon which the flood depends, seems clearly to be due to the combined effect of causes which usually prevent any coincidence between high and low floods and the maxima and minima of the sun-spots from being recognized. A prediction of better floods when a sun-spot maximum is approaching seems to Captain Lyons to go further than the evidence warrants. Nor does the Abyssinian rainfall show a direct and simple relation to + and — pulses of the solar weather cycle, as discussed by the Lockyers for India and Mauritius, and suggested also for the Nile floods. Egypt and Abyssinia seem to form an area whose meteorological conditions are not regularly consonant with those of India as discussed by Sir N. Lockyer, agreeing at times and then differing greatly.

A comparison of the Nile flood-curves with the curves of Brückner's climatic cycle shows that the former approaches to some extent the curve which Brückner gives for areas which he classes as "temporary exceptions," but that the normal Brückner cycle cannot apply to Abyssinian rainfall, and no predictions of coming floods can be based on this cycle. In the variation of the Nile from year to year there is no trace of any definite periodicity which could be of assistance in forecasting the probable duration of any succession of high or low Nile floods. There is a short-period fluctuation in the Abyssinian rainfall, but no more or less regular increase for a number of years, and then a decrease. Further, there is not the correlation between the Indian monsoon rainfall and the Nile floods which has often been stated to exist. Captain Lyons finds that, so far as present knowledge goes, the Nile flood depends primarily on the strength of the monsoon air-currents from the Indian Ocean, modified by the pressure conditions over northeastern Africa. R. DeC. W.

SENATE DOCUMENT NO. 104, 59TH CONGRESS, FIRST SESSION, contains copies of papers relating to the claims of Cope Whitehouse to certain desert lands in Egypt, transmitted by President Roosevelt on the 4th of January, in response to the Senate's resolution of December 7, 1905.

These "desert lands" are better known to those who have followed Mr. Whitehouse's career as the Wadi Raiyan or the Raiyan-Moeris, first explored by him*;

the desert depression west of the Nile and South of Cairo, which is to be filled from the Canal of Joseph by sluice-ways eight miles in length.

Among the papers, all interesting to geographers and Egyptologists, is a bibliographical index (pp. 50-51).

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* BULLETIN, 1882, pp. 85-108; 1889, pp. 530-582.

CLIMATE OF SOUTH AFRICA.—F. S. Watermeyer, Government Land Surveyor, in a paper on South Africa south of the Limpopo (*Scot. Geogr. Mag.*, Jan., 1906) summarizes the climatic features of that region. The Portuguese territory along the east coast is well watered. There is abundant grass, forming excellent pasturage for cattle, sheep, and goats. Semi-tropical fruits can be grown, and the staple cereal products are maize, kaffir corn, and rice, kaffir beans, etc. Along the slopes of the Drakenberg, at about 3,000 ft., coffee, tobacco, and citrus fruits—bananas, pines, etc.—grow luxuriously. Semi-tropical plants and fruits grow less abundantly as the latitude increases southwards. The best wheat-producing parts of South Africa (where no irrigation is used) are on the west coast of Cape Colony from the Elephants' River as far as Mossel Bay and a strip of land along the western slopes of the Drakenberg where the rainfall during April, May, and June is sufficient.

Maize, kaffir corn, manna, potatoes, beans, and peas can be grown throughout South Africa by irrigation, and as summer crops wherever the rains extend; semi-tropical fruits on the Low and Middle Veld, and along the eastern slopes of the Drakenberg southwards; peaches at all altitudes to 2,000 feet or over; plums, pears, apples, etc., especially on the High Veld. The zone of maximum rainfall along the eastern and southern slopes of the Drakenberg and the coast ranges on the south as far as Swellendam is marked by belts of forests.

The altitude of the high plateaux of South Africa lowers the temperature considerably. Farther north, in the Middle Veld and low country, and on the east coast, temperatures of 115° to 120° in the shade are reported as of frequent occurrence. From November to April the rains in the north and east keep the air moist and salubrious, although the temperature is often very high. In winter the air is dry, cold, and healthy. In June, in the Bush Veld, temperatures 12° to 22° below freezing (Fahr.) have been registered between 2 and 6 A. M., and by noon the thermometer may stand at 90°. About the equinox, in September, strong winds from southeast or northwest sweep over the country. These gales generally last intermittently from August to October, and are the precursors of the rains in South Africa. R. DEC. W.

RAINFALL MAP OF AFRICA.—The new rainfall map of Africa, shown at the meeting of the British Association last September by Dr. A. J. Herbertson and Mr. P. C. Waite, shows that the heaviest rainfall occurs around the Kamerun Mountains, where one station—Debunja—has an annual precipitation of about 400 inches, which is not much less than that of Cherrapunji, in the Khasi Hills of India, the record rainfall station of the world. The striking features of the map as a whole are (1) the belt of wet climate round the equator, broken by a drier area near, but not touching, the east coast; (2) the dry belts round the tropics, which do not extend quite to the east coast in the south; (3) the wet southwest and northwest corners; (4) the continuous wet area of varying width which fringes the east coast from Cape Colony to the equator. R. DEC. W.

CYCLONIC WEATHER CONTROL AT KIMBERLEY.—An interesting study of cyclonic control over the hourly normals of the more important meteorological elements at Kimberley is contributed by J. R. Sutton to the *Transactions of the South African Philosophical Society*, Vol. XVI, Pt. 2, Oct., 1905 ("On the Variation of the Hourly Meteorological Normals at Kimberley during the Passage of a Barometric Depression"). The number of separate cyclones studied is 105, and the hourly elements have been considered on the day on which the centre passed over, together with those on the day before and the day after. The depression does not in the least obliterate the ordinary diurnal variation of the barometer. The mean temperature of the first day is from one to two degrees higher than the normal; on the second day it is, on the whole, about 0.5° higher still, and on the third day it is between 3° and 4° lower than the normal. In front of the depression the range of temperature is increased; in the rear it is decreased; while along the trough it is not greatly affected. Such variation as there is in the amount of water vapour is more noticeable in the dryness following the trough than in the dampness preceding it.

There is a positive deviation in the amount of cloud during the second day, and a negative deviation on the third. Cirriform clouds are not much affected in quantity by the depression, the chief influence being in the cumulus and other low forms. In every 100 depressions, rain is observed in 30 on the first day, in 44 on the second, and in 27 on the third. The diurnal variation in wind velocity is evident during the passage of a depression, but the shape of the ordinary curve is considerably modified.

This study of Sutton's is in line with the growing effort to separate the *cyclonic* control of weather elements from the diurnal, monthly, and annual controls. Contributions towards the cyclonic control of rainfall have recently been made by Mill, and now comes this investigation from Kimberley, in which the cyclonic control of the other weather elements is considered. R. DeC. W.

Studying German East Africa.—The Commission for the geographical exploration of the German colonies has published the plan of work which it will endeavour to carry out. The first investigators whom it is sending to the field are Prof. Dr. K. Weule, whose headquarters will be at the station Kondoa-Irangi, on the western edge of the Masai Steppe, and Dr. F. Jäger, whose field is in the region of interior drainage between Mount Kilimanjaro and Victoria Nyanza.

AMERICA.

Contributions to the History of American Geology.—Over 500 pages of the *Annual Report* of the United States National Museum for 1904 are given to a work bearing this title by Dr. George P. Merrill, Head Curator of Geology in the Museum. It is a consecutive history of the rise and progress of American geology from 1785 to recent days. A part of it was first presented in a series of lectures to students in geology in Columbian University, Washington, though many of the facts were gathered later while looking up the records of the early Government surveys. The work Dr. Merrill has carried out is most desirable, and will be very useful. Such a history, if at all comprehensive, should show not merely what has been done and by whom and how it was done, but should also bring into clear light the gradual growth of the science and the development in geological observers of the power both of observation and deduction. This is what Dr. Merrill has done.

He calls attention to the errors and crudities of the early workers, but shows these pioneers also as men who had received little or no preliminary training in observation and deduction, who had access to very few books, and who had almost none of the information with which the geologist of to-day begins his career. Trained geologists, of course, know the story of the evolution of their science, but this history cannot fail to be of value and interest to younger students and the general public, who will see in this work "by what years of toil each new fact has been unearthed, cleansed of the débris which obscured its outlines, and treasured up in such form that it is now possible for the student in a few short years to encompass the garnerings of a century."

Many portraits of the long line of our geological workers are given, and also appendices showing the gradual development of the geological column as it appears in the principal text-books and biographical sketches of the leading workers in American geology. The index is copious.

LOCAL GLACIATION IN THE CATSKILLS.—It is a well-known fact that the elevation of the Catskills gives to them both a lower mean annual temperature and a greater rainfall than the lower parts of the State. Evidently, therefore, it is natural to expect that during the closing stages of the Ice Age local glaciation lingered in the higher mountain valleys after the icecap itself had disappeared. It has been shown that this was the case in other mountain regions in the eastern United States—the Adirondacks, Green and White Mountains, and Ktaadn, in Maine; and both Chamberlin and Smock have called attention to the probable existence of such glaciers in the Catskills. The first definite proof of this is brought forward by J. L. Rich (*Jour. Geol.*, Vol. XIV, 1906, pp. 113-121), who both describes and illustrates the clear evidence of local glaciation in the Flybrook valley, a tributary to Schoharie Creek. There are distinct concentric moraines in a cirque-like valley with enclosing mountains rising 3,360 to 3,448 feet above sea-level. Rich shows that they are concave upstream, proving local glaciation as contrasted with general, and that they merge upstream into descending lateral moraines. His evidence is convincing, and is an important contribution to the Pleistocene history of New York. It raises an interesting question here, as in other mountain regions of the East, as to the extent of this local glaciation. The answer ought not to be difficult, but, so far, it has not been given in this country. Judging from the facts discovered in the British Isles, we have reason to suspect that our Eastern mountains were important factors in the waning stages of the Ice Age, and in scientific study the present geography ought to determine this point. The Catskills offer an opportunity for such a study. R. S. T.

CLIMATIC FEATURES OF THE ICE AGE.—Prof. Albrecht Penck, in a recent number of the *Geographical Journal* (Feb., 1906, Vol. XXVII, pp. 182-187), presents an interesting discussion of the climatic conditions which led up to the Pleistocene Ice Age. His conclusion is that a rather slight decrease in the annual temperature—perhaps no more than 2°-3° C.—will suffice to cause an Ice Age if connected with a diminution of the summer temperature. The close parallelism of events now in progress in both the northern and southern hemispheres indicates a common origin both for recession of glaciers and desiccation of arid lands. This cause seems to be a very slight increase in temperature, thus increasing the ablation of glaciers and the evaporation in arid regions. The argument leading up to these conclusions is ingenious and convincing, but too long for presentation in a brief abstract. R. S. T.

COON MOUNTAIN'S SO-CALLED CRATER.—Messrs. D. M. Barringer and B. C. Tilghman have made an examination of Coon Mountain in Arizona, and the results of their work are published in the *Proceedings* of the Academy of Natural Sciences of Philadelphia (December, 1905). Coon Mountain or Butte rises above the plain about five miles south of Sunshine station in Coconino County, Arizona. The evidence collected has convinced the investigators that the "crater" was produced by the impact of an iron body falling out of space. The so-called mountain consists of a circular ridge from 130 to 160 feet in height, surrounding an almost circular depression in the earth varying from 3,600 to 3,800 feet in diameter and about 400 feet deep. Viewed from the inside the surrounding ridge is about 560 feet above the level of the crater bottom. As this hole has a general resemblance to a crater, some observers have surmised that it was really the crater of a long-extinct volcano. The rim around it, however, is not composed of volcanic outpourings; the hole penetrates strata of red sandstone, yellowish limestone, gray sandstone, and, finally, a brownish sandstone, in which it terminates. The writers dismiss as untenable the theory that this is a volcanic crater.

Another theory is that the hole was produced by a steam explosion; but the vast amount of steam required could be stored up only in regions of volcanic activity, and there is no evidence that this was ever such a region.

The writers believe the evidence to be overwhelming that the cavity was formed by the impact of a large meteorite. Much of the rock was ground by the collision into fine particles and almost impalpable dust, and a great part of the crater rim is formed of this débris. The colliding body itself was, to a large extent, broken into pieces. Borings have revealed small fragments and splinters of it, but no large piece has been found beneath the floor of the crater. On the other hand, several tons of meteoric iron have been collected around the crater. Seven pieces of it weigh from 600 to over 1,000 pounds each, and smaller pieces were found around the crater to a distance of two and a half miles. These iron specimens contain iron, nickel, iridium, and platinum, and there are millions of particles of it scattered far and wide around the crater. A shaft is now to be sunk in the centre of the crater, and, if possible, sufficient depth will be reached to demonstrate whether or not there are parts of the supposed foreign body buried several hundred feet beneath the central plain.

THE SAN FRANCISCO EARTHQUAKE AND FIRE.—Months will elapse before the earthquake which destroyed a large part of San Francisco on the morning of April 18 can be described in a satisfactory manner, but a brief statement of the event, and of the fire that followed it, may be made here in advance of the results of the investigations now in progress. These results will finally make it possible to publish the facts of special scientific interest.

The quick succession of severe earth movements that caused the destruction occurred about 5.15 A. M., and appears to have continued less than a half minute. The movement was apparently from south to north. Nearly all buildings were violently wrenched, and many of the frailer ones fell in ruins. Modern business buildings with steel frames stood the shock well, and remained practically intact in the vital points of their construction, though their facing of stone, to a greater or less extent, was toppled into the street. The satisfactory result of this very severe test of the efficacy of steel framework in large buildings will probably increase its use in cities where earthquake phenomena are common. Such architectural features as cornices suffered very severely, and many streets were blocked by débris. The loss of life appears to have been less than 300.

Seismographs reported the shock the world around. Many of the outlying towns in California suffered severely. The area within which the disturbance was sensibly felt, however, seems to have been much smaller than that which was within the range of the Charleston earthquake of 1886.

As is usual, fire followed closely after the shock. The water system was completely crippled, and there was no water to fight the flames. Beginning after the work of the earthquake, the fire did not completely burn itself out till April 23, five days after the shock. Approximately, seven square miles were burnt over, including the entire business district. The walls and steel framework of many buildings are still standing. In the course of a few days nearly 200,000 persons were able to leave the city to find temporary homes elsewhere. About the same number remained in the city, and the whole country participated in the effort to organize relief and get it to the sufferers as quickly as possible.

THE GEOLOGICAL SURVEY OF GEORGIA IN 1905.—At the beginning of the year, the large exhibit of the mineral resources of Georgia made by the State, through its Geological Survey, at the Louisiana Purchase Exposition in St. Louis, was returned to the Capitol and installed in the State Museum. W. S. Yeates, State Geologist, was largely engaged with administrative work. In field work, one of the assistant geologists completed a study of the contact between the Cretaceous and Tertiary formations along the line from Columbus to Macon and Augusta, preparatory to the completion of a preliminary map of the geology of Georgia. He was also engaged in field work on the iron ores of Georgia, so as to complete a second report on the iron ores of the State, to be published as *Bulletin* No. 10-B.

The edition of *Bulletin* No. 1, on the marbles of Georgia, having been exhausted, and there being continued demand for this report, additional data were procured in the field and a new edition, revised and enlarged, is now going through the press. The other Assistant Geologist began field work for a second report on the clays of Georgia, to be published when completed, as *Bulletin* No. 6-B. There are now in press *Bulletin* No. 13, on the ochre deposits; *Bulletin* No. 14, on the manganese deposits; *Bulletin* No. 15, on the underground waters of Georgia. A long report on the water-powers of Georgia has been submitted to the State Geologist by one of his assistants, and will be published as *Bulletin* No. 3-B.

HIGHEST MOUNTAINS IN THE UNITED STATES.—The fourth edition of the United States Dictionary of Altitudes gives new determinations of the heights of Mounts Whitney and Rainier. The elevation assigned to Mount Whitney is 14,502 feet, while in the third edition it was 14,898 feet (BULLETIN, 1905, p. 734). Mount Rainier's height is given as 14,363 feet, the earlier figures having been 14,526 feet. Mount Whitney leads in elevation among our mountains south of Canada, but Mount Williamson in California, according to the Dictionary, is only two feet lower. Colorado has twenty-seven mountains over 14,000 feet in height, very few of which are known by names to the general public excepting Pike's Peak, Holy Cross Mountain, and others which, owing to accessibility, history, or outlook, have especially attracted attention. Elbert Peak, 14,421 feet, is the culminating summit in Colorado. California has eleven mountains over 14,000 feet high. Eight of Alaska's summits rise above 15,000 feet, with Mount McKinley, 20,464 feet, and St. Elias, 18,024 feet, in the lead.

THE HUDSON BAY ROUTE.—Mr. A. P. Low, the newly-appointed director of the Geological Survey of Canada, addressing the Canadian Club at Montreal, declared that Hudson Bay and Hudson Strait were navigable for ordinary vessels for four clear months in the year—from July 15 to November 15. The distance from the Canadian wheat-belt to Fort Churchill was, he said, less than the distance to the head of navigation on the Great Lakes, while from Fort

Churchill to Liverpool the distance was the same as from Quebec to Liverpool. Therefore the shipping of grain from the North-West to Great Britain by the Hudson Bay route would save the heavy cost of transport from the Great Lakes to Quebec. Mr. Low expressed his conviction that this route would be utilized in the near future.

THE ROCKY MOUNTAINS PARK OF CANADA.—The *Report* for 1905 of Superintendent Douglas, of the Rocky Mountains Park of Canada, shows that considerable additions were made to the roads and bridle trails, opening new points from which to view the splendid scenery of this great national park. About 5,000 tourists were turned away from Banff last season for lack of accommodations. The hotels are excellent, and a number of them are being enlarged to meet the increasing demands of the tourist season. The discovery of the Deutschman caves, about six miles from Glacier House, apparently adds a new attraction to the great playground. About four-fifths of a mile of passageways have thus far been surveyed in the Cañon, the main cave, the descent into which was made last year by a rope down a nearly perpendicular incline. The average height of the main passage is about 100 feet, with a width of from 8 to 20 feet. The cave was formed by water-erosion in very hard crystalline limestone consisting of alternate bands of white mottled and grey marble. A carbonate-of-lime coating on the walls forms its decoration. It is estimated that the erosion of this cave required a period of nearly 40,000 years. Only a part of the cave has yet been explored, and a great deal of work must be done before this and other caverns in the group are made accessible to the general public.

EARTHQUAKE IN SOUTH AMERICA.—On the last day of January the western coast of Colombia and adjacent portions of Ecuador were the scene of intense seismic activity. Scientific details have not been received, but it is known that the shock was first felt in the province of Esmeraldas, Ecuador, at 10 A. M., and the disturbance was frequently repeated until Feb. 6, the inhabitants living in a state of panic and abandoning their houses for the open air. The epicentral tract was apparently the sea-floor some distance from the land. Waves caused by the shocks swept in, flooding the principal streets of Esmeraldas, while Tumaco, a small Colombian island, was overwhelmed, many persons being drowned. Near Port Limones four small islands are said to have disappeared, though the fishermen there had time to escape in their boats. Various buildings in Esmeraldas were overthrown and many Colombian towns were severely shaken, the damage and loss of life being apparently greatest at Mosquera, San Juan, and Domingo Ortiz, while Antioquia and other departments suffered severely.

Professor John Milne reports that he obtained an excellent series of seismograms at his observatory on the English coast, indicating an unusually large collapse. He says (*Geog. Jour.*, April, 1906) that in the history of seismic disturbance in this region it is remarkable how often convulsions in the Cordillera have found a response in the West Indies. To go no further back than 1902, the great disaster at St. Pierre had been preceded by severe disturbances in Guatemala. A record of cable fractures off the west coast of South America shows that the portion of the sea-floor off the mouth of the Esmeraldas River has been particularly liable to changes of contour.

GEOGRAPHICAL DICTIONARY OF THE DEPARTMENT OF CHUQUISACA, BOLIVIA.—The Geographical Society of Sucre has issued a gazetteer of this political subdivision of Bolivia in which Sucre is situated. The *Diccionario de Chuquisaca* contains 372 pp., well printed, with the names arranged in alphabetical order and the geographical, historical, and statistical data relating to each topic. The introduction gives a summary of the orography and hydrography of the Department, the physical geography is further treated under the name of each canton, and the environs of each of the larger towns are described in detail. The range of geographical topics is wide enough to include the haciendas or landed estates.

ARGENTINE SCIENTIFIC STATIONS IN THE FAR SOUTH.—A cable despatch from Buenos Aires says that the Argentine Government has purchased the polar ship of the Charcot Expedition, renamed it *Le Français,* and will utilize the vessel to keep up communications with the meteorological and magnetic station founded by Mr. Bruce in the South Orkneys. The Government intends to establish an Antarctic scientific station on Wandel Island, Charcot's winter quarters.

ASIA.

THE KANGRA EARTHQUAKE OF APRIL 4, 1905.—The *General Report* of the Geological Survey of India for 1905 (*Records,* Vol. XXXIII, Part 2, 1906) contains a review of the destructive earthquake that devastated the Kangra valley last year, among the foothills of the Himalayas in the eastern part of the Punjab. For the more critical study of the effects, four officers of the Geological Survey were detailed to the affected areas. The destruction of life in the epicentral tract was enormous, as the earthquake began with little warning at an early hour, when most persons were still asleep. Almost all the buildings in the Kangra area were destroyed, there was great damage and considerable loss of life in the hilly tracts of Mandi State and Kulu, serious damage in Dehra Dún, Mussoorie, Chakráta, and other towns, and slight damage in the large towns of Lahore, Amritsar, Jullundur, Saháranpur, and others similarly placed with reference to the centre of disturbance. Far outside these regions the effects were felt with constantly-diminishing intensity, until the limits of its appreciation by the unaided senses coincided roughly with part of an ellipse passing through Quetta, Surat, Ellichpur, False Point, and Lákhimpur. This curve, if continued, would pass into the little-known regions of the higher Himalaya and Tibet. It is believed that the total area affected was about 1,625,000 square miles. The earthquake was therefore a notable one in seismological history; and as 20,000 persons are estimated to have perished by it, it was one of the most disastrous of modern times.

These points were noticed with regard to the surface effects. All the surface valley deposits (alluvium, etc.) were proportionately more shaken than the solid rock; the soft Tertiary sandstones were thrown into more destructive vibrations than the older and more compacted strata; narrow ridges with free ends (spurs) were very much more shaken than broad areas and the flat hollows between the spurs; the more distant vibrations and tremors were weakly felt in alluvium, in the flat-lying Vindhyans and the Deccan trap, while no results were reported from the ancient and steeply-dipping Aravalis, and this area was similarly barren of results in the earthquake of 1897. The earth-waves travelled to Japan at the rate of 2.05 miles a second. There were two foci of the disturbance. The main focus was in the Kangra area parallel with the folded Tertiary rocks, and its depth was about 18 to 30 miles. The subsidiary focus was parallel to the first under the Tertiary mass in the Dehra Dún area.

Dr. Sven Hedin's Journey through Persia.—A telegram from Teheran, dated April 10, announced the arrival of Dr. Sven Hedin in Seistan on the previous day after an extremely interesting journey by Jandak, Turoot, Khur, Tabbas, Naiband, and Neh, in the course of which he crossed the Dasht-i-Kavir, the great salt desert, three times. The explorer said he was in splendid health, and had collected material for a work on eastern Persia. He had made a map of 162 sheets, had taken hundreds of photographs and sketches, and had formed a geological collection. He was to leave for Nushki on April 12.

Explorations in the Tarim Basin.—According to the Paris correspondent of the London *Times,* the Paris Société de Géographie has entrusted to Mr. Peliot, a young French Professor of the Chinese language, a scientific mission which will comprise explorations in the country north of Tibet where Sven Hedin, Stein, and others have found ruins bearing witness to a flourishing ancient civilization. The Société has supplied about 200,000 francs to be used in his work.

A 300-Year Climatic Cycle in China.—In a recent number of *Nature* (Vol. 73, 1906, 413-414) a correspondent in Shanghai, Mr. T. W. Kingsmill, points out that a study of droughts in China reveals a periodicity of about 300 years. This period has lately been discussed by Mr. H. W. Clough in the *Astrophysical Journal,* who arrives at the conclusion that a 300-year cycle exists in solar and in allied terrestrial phenomena. Mr. Kingsmill notes that the climatic cycle of about thirty-four years (Brückner) seems to agree with three sun-spot cycles, while the longer period of 299¼ years seems to correspond with twenty-seven sun-spot cycles. R. DeC. W.

AUSTRALASIA.

Rainfall Map of New South Wales.—The Sydney, New South Wales, Observatory has published a mean annual rainfall map of the colony. At each station the mean annual rainfall is down in inches and hundredths, and, in addition, the usual isohyetal lines are drawn for every five inches. The annual means are computed from all yearly records available, covering generally from twenty to forty years. There is, therefore, no reduction to the same period of time; but although the map is doubtless to some extent misleading on that account, the larger facts are shown with sufficient accuracy for ordinary purposes.

R. DeC. W.

Snowstorm of August, 1905, in New South Wales.—The Observatory at Sydney, New South Wales, has published an interesting chart showing the extent of a snowstorm on August 29th and 30th, 1905. Every station at which snow fell is indicated by a small circle. This snowfall, as is pointed out by Mr. Henry A. Hunt, Acting Meteorologist of the Sydney Observatory, was somewhat remarkable, in that it reached a very low latitude late in the season. In the English translation of Hann's *Handbuch der Klimatologie*, Vol. I, p. 314, the equatorial limit of occasional snowfall in Australia is given as latitude 34° S., and on page 313 the statement is made that snow has fallen once at Sydney. In the snowstorm of August 29th and 30th last, snow is noted as having occurred at Hanover, in latitude about 29.1° S. R. DeC. W.

EUROPE.

The Marseilles Exhibition.—The oceanographical exhibition which has been in preparation for some time at Marseilles will be opened to the public between

April and October. The exhibits will especially illustrate the results of deep-sea exploration and of the recent researches in the polar regions. All matters connected with the scientific study of the sea and its fisheries will be shown. The exhibition will have an international character, and the co-operation of the leading oceanographers of all nations was invited. The principal institutions in Great Britain connected with the study of oceanography and marine biology organized a Committee under the presidency of Sir John Murray, and a representative British exhibit has been sent to Marseilles. The polar exploring vessel *Scotia* will be on exhibition, and also a model of Captain Scott's ship *Discovery*. In September the French Colonial Congress will be held in connection with the exhibition, and a Congress of geographical societies will also be arranged under the presidency of M. le Myre de Vilers, President of the Paris Société de Géographie.

RAINFALL OF ENGLAND AND SOUTHEAST TRADE VELOCITY.—Dr. W. N. Shaw, Director of the British Meteorological Service, has made a study of the connection between English rainfall and the velocity of the southeast trade at St. Helena (*Nature*, Dec. 21, 1905). In these days, when more and more evidence is accumulating of a correlation between the variations of one meteorological element in one region and the variations of quite another meteorological element in a very different region, one is not surprised at the results of Dr. Shaw's investigation; but the conclusions are wholly new, and very interesting. The year 1903 was one of exceptionally high trade-wind velocity; it was also a year of heavy rainfall in England. The year 1893 was one of drought in England; it was one of very low wind velocities at St. Helena. When the monthly values of wind velocity at St. Helena for the whole period are plotted (1892-1903), and together with these the seasonal rainfall in the south of England, there is a remarkable similarity in the curves. In 1898 there were two maxima of wind velocity, instead of the usual one maximum, and the rainfall of southern England also showed two maxima; the first, in May, two months after the unusual second maximum of wind velocity at St. Helena; the second in November, a month later than usual, and the second maximum of wind velocity at St. Helena was also a month later than usual. The evidence in favour of a connection between St. Helena trade-wind velocities and south England rainfalls can, Dr. Shaw believes, "hardly be pure coincidence." R. DEC. W.

A COMPARATIVE STUDY OF SCOTTISH AND DANISH LAKES.—Dr. Wesenberg-Lund of the Danish Fresh-water Biological Station was invited in 1904 by Sir John Murray to spend a few weeks in exploring the Scottish lakes, in order to make a comparison between them and the Danish lakes. In other words, he desired to compare the lakes of a highland with those of a lowland country. He has written a paper on the results of these studies (*Proc.* of Roy. Soc. of Edinburgh, Vol. XXV, Part I, pp. 401-48, with four plates). The following are some of his conclusions as to the physical characteristics of the lakes:

> The foregoing remarks refer only to the character of the Danish and Scottish lakes, but I feel convinced that many of the facts stated are common to lakes belonging respectively to the great Central European plain and to alpine countries. As traits common to all the first-mentioned lakes, I would specially point to their shallowness, their gently sloping shores, their roundish outline, the high temperature of the surface water in summer and the freezing over in winter, the ice-erosion on the shores. the small transparency, and the yellow or yellow-green colour of the water in summer, due to the huge plankton-masses. Differences may be looked for with regard to the chemical composition of the water and bottom-mud, owing to the varying chemical compositions of the soil in different countries; I anticipate that further investigations will prove that the large amount of lime carried by streams into

our lakes is one of the most characteristic peculiarities of the Danish lakes. On the other hand, I am of opinion that the features mentioned in connection with the Scottish lakes are common to alpine lakes in general. Especially would I call attention to their great depth and long and narrow form, their precipitous shores, the sudden flooding of the rivers and the rapid changes in the level of the lakes, and the slight amplitude in the annual variation of the surface temperature. Peculiar to the Scottish lakes are the small transparency and yellowish-brown colour of the water, to which may undoubtedly be added the large amount of humic acid. These peculiarities may be traced to and are closely connected with the strongly climatological and geological conditions common to the whole country.

(A Comparative Study of the Lakes of Scotland and Denmark. By Dr. C. Wesenberg-Lund of the Danish Fresh-water Biological Station, Communicated by Sir John Murray. Proceedings of the Royal Society of Edinburgh, Vol. XXV, Part 1, p. 411.)

CLIMATE OF THE FAROE ISLANDS.—The Faroe Islands lie in the course of the Gulf Stream and but a short distance from the edge of the cold polar current which sweeps around the east coast of Iceland. Hence the climate is variable and uncertain, although the ranges are small. The summers are cool and the winters mild. At Thorshavn the January mean is given as 37.8°, and the July mean as 51.4°. In twenty-five years the absolute extremes were 11.1° and 70.1°. Fog is most common in summer. Clear days are always rare. If a clear day is taken as one with not more than one-fifth of the sky cloudy, there are at Thorshavn, on the average, only six clear days a year. Most of the rainfall comes in autumn and winter, as usual in a marine régime of rainfall. Snow rarely lies more than a week or so near the shore. In some localities it may gather on the slopes and cause avalanches.—(*Scot. Geogr. Mag.*, XXII, 1906, 63.)

R. DEC. W.

ALPINE MUSEUM IN BERN.—The Alpine Museum which was opened in Bern last year has among its exhibits the superior relief models of the Swiss Alps by Professor Heim and engineer Simon and the finest specimens of Swiss Alpine cartography, as the great Dufour maps and the modern relief maps. Many exhibits illustrate the Alpine fauna and flora, methods of rescue in accidents, models of club huts, geological specimens, the development of the mountaineering outfit, Alpine pictorial art, etc. The Museum is under the direction of a Commission, and it will publish "Wissenschaftliche Mitteilungen," of which the first number, "Das Alpine Rettungswesen der Schweiz," by Dr. W. Kürsteiner, has appeared.

THE CINEMATOGRAPH IN EXPLORATION.—Ethnological expeditions are beginning to use the cinematograph, and are finding it a very helpful appliance. The Seligmann Expedition, which recently returned from British New Guinea, brought photographic representations not only of the natives posed in groups but also of the natives in movement. These moving pictures show native dances and other phases of recreations, ceremonies, and occupations. Dr. A. C. Haddon, commenting on Dr. Seligmann's illustrated lecture before the Royal Geographical Society, said that he had seen many of these dances, and it was extremely interesting to him to see them again on the screen, but he missed the colour, the noise, and the excitement which accompany them. The hope was expressed that scientific societies would encourage the use of this method of depicting life among savage peoples.

THE NINTH INTERNATIONAL GEOGRAPHICAL CONGRESS.—The Committee on Organization appointed by the Geographical Society of Geneva has chosen Dr. Arthur de Claparède as President of the Ninth Congress, which will meet in that city July 27—Aug. 6, 1908.

AWARDS OF THE ROYAL GEOGRAPHICAL SOCIETY.—The Council of the Royal Geographical Society has awarded the medals and other honours for 1906 as follows: The Founder's Medal to Mr. Alfred Grandidier for the results of his many years' work on the island of Madagascar; the Patron's Medal to Dr. Robert Bell, who, during forty-five years of field work, mapped a large area of unknown Canada; the Victoria Research Medal to Professor W. M. Ramsay for his studies and field work in ancient geography during nearly thirty years; the Murchison Award to Major H. R. Davis for his explorations in the Shan States, Kachin Hills, Yunnan, Siam, and Sechuan; the Gill Memorial to Major A. St. Hill Gibbons for his exploring and survey work in Barotseland on his two expeditions of 1895-96 and 1898-1900; the Cuthbert Peek Fund to Major H. H. Austin for explorations in the Lake Rudolf and Sobat regions and other work; and the Back Bequest to Major R. G. T. Bright for his eight years of explorations in the Sudan, Uganda, and East Africa.

THE SIMPLON TUNNEL.—The Simplon Tunnel will be opened to public traffic on June 1 next. The first passenger train went through the tunnel on the 25th of January. It consisted of a locomotive and four cars. Entering the tunnel at Brig at 8.46 A. M., it reached the station at the south end of the tunnel at 9.33 o'clock.

OCEANOGRAPHY.

THE PRINCE OF MONACO'S CAMPAIGN LAST YEAR.—Prince Albert of Monaco has printed a brief report on the seventh scientific campaign of the *Princesse Alice* (*Comptes rendus de l'Académie des Sciences,* March 12, 1906; reprinted as *Bulletin* 69 of the Musée Océanographique de Monaco). His voyage was to the Sargasso Sea in the mid-Atlantic, the chief purposes being to study the deep-sea fauna and that of the Sargasso Sea and the meteorology of the upper air. One hundred and eighteen soundings were made to a depth of 5,580 meters, and many specimens of the sea-floor were secured. The vessel returned to Marseilles on September 24, after a voyage of sixty-four days. Most of the report is given to an account of the fauna obtained, which included some rare and new species. The life of the Sargasso Sea was studied at the surface, middle depths, and on the sea-floor at a depth of 3,465 meters. The animal life amid this vegetation is numerous, but not remarkably varied. Specimens of Actinozoa, Ascidiæ, Nudibranchiata, crabs, isopods, fish, and a few other animals were obtained. A tendency to mimicry is particularly noteworthy among the Sargasso fauna. While in this sea five swallows (*Hirundo rustica erythrogaster* Bodd, American variety) visited the vessel, though it was distant nearly 900 miles from the nearest continent. The Prince calls attention to the absence of nearly all animal life at the surface of the sea in all the regions swept by the trade-winds between the Tropic of Cancer, the Azores, and Africa. In this region he has never seen whales or sea-fowl. Flying fish and plankton alone animate this desert. Twenty-six balloons were sent up for meteorological records and thirteen kites, and an altitude of 16,000 meters was attained.

NOTES.

Dr. Fridtjof Nansen, who was appointed Norwegian Minister at London, last November, has been raised to the rank of Ambassador.

Professor Albert P. Brigham, of Colgate University, will conduct a geological course at the summer school of the University of Wisconsin this season.

Miss Ellen C. Semple, of Louisville, will lecture on Anthropology at the University of Chicago during the summer term.

Professor Henry J. Cox, of the U. S. Weather Bureau Service, has been elected President of the Geographic Society of Chicago, to succeed the retiring President, Dr. Paul Goode.

The Geological and Natural History Survey of Wisconsin is publishing a report by Professor U. S. Grant on the lead-and-zinc region of south-western Wisconsin. It contains a general geological map of the region and nine large-scale topographical and as many geological maps of the more important mining areas in the district.

Dr. O. C. Farrington, of the Field Museum of Natural History, is giving a series of lectures on "Meteorites," at Walker Museum, University of Chicago, on Wednesday afternoons in April and May. His subjects are: (1) "History and Astronomical Relations"; (2) "Phenomena of Fall, Size, Shape and Distribution"; (3) "Structure and Classification"; and (4) "Composition and Terrestrial Relations."

Professor T. C. Chamberlin, of the University of Chicago, gave an address on May 11 before the Geographic Society of Chicago on "Secular Changes in Climate."

The Geographical Society of Philadelphia held its annual dinner on April 21. Among the guests of the Society on that occasion were Professor Libbey, Admiral Melville, Dr. Willis L. Moore (Chief of the Weather Bureau), and Mr. Gilbert H. Grosvenor.

Among the French explorers who by decrees of March 9 and 12 were named for decorations in the Legion of Honour were Gautier (Sahara), Le Chatelier (Sahara, Sudan, Congo), De Flotte de Roquevaire (Morocco), L. Gentil (Morocco), Mehier de Mathuisieulx (Tripoli), Rabot (Greenland, Lapland), Lenfant (Niger, Chad), and Superville (Ubangi).

An atlas of European History, containing some forty-eight maps, has been published through Holt & Company.

U. S. BOARD ON GEOGRAPHIC NAMES. DECISIONS, APRIL 4, 1906:

BIG PUCKETA: creek, Allegheny and Westmoreland counties, Penn. (Not Big Pucketta, Paucatoes, Pocatoes, Poketo, Pucketta, Poccatoes, nor Puckety.)

CAMP HAGERMAN: railroad station and town, Warren county, Ohio. (Not Hageman.)

CHATAHOSPEE: creeks (Big and Little) tributary from the east to Tallapoosa river, Chambers and Tallapoosa counties, Ala. (Not Chattahospee, Hoolethlocco, Hoolethloces, Hoolethloco, nor Hootethlocco.)

ELLICOTT CITY: county seat, Howard county, Md. (Not Ellicott nor Ellicotts Mills.)

FLATHEAD: river, Flathead county, Montana, and in Canada. (Not Flathead River North Fork nor North Fork Flathead.)

KEARNY: town, Hudson county, N. J. (Not Kearney.)

KENAI: stream, draining Lake Shilak, Kenai peninsula, into Cook inlet, Alaska. (Not Kaknu.)

MEADOW: mountain, Warren town, Knox county, Me. (Not Congress.)

MEGUNTICOOK: lake, Camden town, Knox county, Me. (Not Canaan nor Lincolnville.)

North Aowa: north branch of stream, Dixon county, Neb. (Not Agoway, Aowa, Ayowa, Iowa, nor Ioway.)

Nutten Hook: village, Columbia county, N. Y. (Not Coxsackie, Newton Hook, nor Nuttenhook.)

* Prince Georges: county, Md. (Not Prince George nor Prince George's.)

Queen Anne: county, Md. (Not Queen Ann, Queen Anne's, Queen Ann's, nor Queen Anns.)

Reids Grove: railroad station and village, Dorchester county, Md. (Not Reed's Grove, Reeds Grove, Reedsgrove, nor Reid's Grove.)

St. George Island: election precinct and island, St. Marys county, Md. (Not St. George's Island nor St. Georges Island.)

* St. Marys: city, county, and creek, St. Marys county, Md. (Not St. Mary nor St. Mary's.)

Scuppernong: river, Jefferson and Waukesha counties, Wis. (Not Schupernong nor Scupernong.)

* Tenants Harbor: lighthouse and village, Knox county, Me. (Not Tenant's Harbor, Tennant Harbor, nor Tennant's Harbor.)

COLORADO.

Bison mountain: Tarryall mountains, Park county.

Black mountain: Park county. (Not Basaltic.)

Buffalo peak: Tarryall mountains, Park county. (Not Freemans.)

Cathedral peaks: West Elk mountains, Gunnison county. (Not Mendicant ridge.)

Crestone peaks: Sangre de Cristo range, Saguache county. (Not Three Tetons.)

Del Norte peak: San Juan mountains, Rio Grande county. (Not Pintada.)

Electric peak: Sangre de Cristo range, Custer county.

Granite butte: group of hills, Teller county. (Not Catamount hills.)

Green mountain: on plains at base of Front range, Jefferson county. (Not Hendricks peak nor Mt. Hendricks.)

Greenhorn mountain: Wet mountains, Huerfano county. (Not Cuerno Verde.)

Hunts peak: Sangre de Cristo mountains, on the boundary between Saguache and Fremont counties.

Kit Carson peak: Sangre de Cristo range, Custer and Saguache counties. (Not Frustum.)

Mesa mountain: Saguache county. (Not Del Norte.)

Mountain Princeton: Sawatch range, Chaffee county. (Not Chalk.)

Mount Sneffels: San Juan mountains, Ouray county. (Not Mount Blaine.)

Music pass: Sangre de Cristo range, Custer county.

Ohio peak: Elk mountains, Gunnison county. (Not Anthracite.)

Outray peak: Sawatch range, Chaffee county. (Not Hump mountain, Mount Ouray, nor Ouray mount.)

Purple mountain: Elk mountains, Gunnison county.

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* Reversal of former decision.

SADDLE MOUNTAIN: Park county. (Not Quadrate.)

SHAVANO PEAK: Sawatch mountains, Chaffee county. (Not Mount Shavano nor Mount Usher.)

SIERRA BLANCA MOUNTAINS: Sangre de Cristo range, Costilla county. (Not Cerro Blanco.)

SIGNAL BUTTE: Teller county. (Not Cheops pyramid.)

THUNDER BUTTE: Douglas county. (Not Christs.)

TOPAZ MOUNTAIN: Tarryall mountains, Park county. (Not Pyramid.)

TRACHYTE KNOB: Teller county. (Not Iron knoll nor Iron mountain.)

TROUT CREEK PASS: Trout Creek hills, between Chaffee and Park counties. (Not Bath, Summit, nor Trout.)

TURKSHEAD PEAK: Front range, Jefferson county. (Not Turkey Head, Turkeyhead, nor Turks Head.)

VIRGINIA PEAK: Front range, Jefferson county. (Not Craigs.)

President Roosevelt has ordered that there be added to the duties of the United States Board on Geographic Names the duty of determining, changing, and fixing place-names within the United States and insular possessions, and that all names hereafter suggested for any place by any officer or employee of the Government shall be referred to that Board for its consideration and approval before publication. In these matters, as in all cases of disputed nomenclature, the decisions of the Board are to be accepted by the Departments of Government as the standard authority.

AMERICAN GEOGRAPHICAL SOCIETY.—TRANSACTIONS, APRIL, 1906.—A Regular Meeting of the Society was held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, April 17, 1906, at 8.30 o'clock, P. M.

Mr. Levi Holbrook in the chair. The following persons, recommended by the Council, were elected Fellows:

Ellsworth M. Taylor.
Joseph B. Morrell.
George Oxenbridge Thacher.
Frank B. Taylor.
C. C. Leffingwell.
Fritz B. Talbot.
Alfred Holt Stone.
Herman K. Viele.
James Slater.
Henry B. Tindall.
T. C. Trask.
Frederick Richardson Griffith.
Edward S. Toothe.
Edgar A. Weimar.
Samuel H. Wheeler.
Richard H. Williams.
John Y. Bayliss.
Mahlon A. Winter.
Charles Addams Worrall.

The Chairman then introduced Mr. Howard W. Du Bois, who addressed the Society on A Mining Engineer's Reconnaissance in the Canadian Rocky Mountains. Stereopticon views were shown.

On motion, the Society adjourned.

ERRATA for article on *Glaciers and Glaciation of Yakutat Bay, Alaska,* Vol. XXXVIII, 1906, pp. 145-167:

p. 146, first foot-note, second line, change *desires* to *deserves.*

p. 150, last line, second paragraph, change 14 and 15 to 13 and 14.

The numbers and legends for figures 23 and 24 have been placed under the wrong half-tone. These should be transposed.

On the map, proof of which was not seen by the authors, *Yakutat Country* should read *Yakutat Cemetery*. *Galiado Glacier* should read *Galiano Glacier.*

As originally written, this paper had a section describing a recent remarkable change of level, which occurred in September, 1899. The elevated and depressed shore-lines were indicated, to illustrate this part of the paper, which was not printed. An account of this change of level will appear in a forthcoming number of Volume XVII of the *Bulletin* of the Geological Society of America.

NEW MAPS.

AFRICA.

Congo Free State.—Mission Scientifique Congo-Nil. Itinéraire Parcouru d'Octobre, 1902, à Avril, 1905. Scale, 1:1,000,000, or 15.7 statute miles to an inch. By Commandant Ch. Lemaire and Lieutenants A. Paulis and A. Caroelli. Issued by the Congo Free State, 1900.

The map gives the route of the Lemaire Expedition between the Congo and the Nile, shows the points whose longitude was determined, and the methods used, together with the villages, camps, mountains, and the altitudes measured.

French Congo.—Le Tchad. Aspect général en fin Avril, 1904. Scale, 1:400,000, or 6.3 statute miles to an inch. By Captain J. Tilho, *La Géographie,* No. 3, Paris, 1906.

This very detailed map of the lake is based upon the surveys of six French officers during the French explorations of February-May, 1904. A number of new points were astronomically fixed, and the map is the best yet made of this lake, now far advanced toward desiccation. The scores of sand-banks which have arisen as little islands along the east coast are shown, and there are lines of soundings giving the depth of water in various parts of the lake.

Egypt.—Carte des Chemins de L'État et des Compagnies agricoles. Scale, 1:400,000, or 6.3 statute miles to an inch. (2 Sheets.) Bureau des Études, Cairo, 1905.

Shows in black the single and double track Government and three private railways and in red the lines of the two companies operating the Delta and Fayum Light Railways. The neighbouring desert routes are indicated. The name of every railroad station from the Mediterranean to Assuan is inserted, and there are insets of Cairo, Alexandria, and their environs on a scale of 1:100,000, or 1.5 statute mile to an inch.

AMERICA.

U. S. Geological Survey Maps.

Geologic Atlas of the United States. Washington, D. C., 1906.
No. 131. Needle Mountain Folio, Colorado. Scale, 1:62,500.
No. 132. Muscogee Folio, Indian Territory. Scale, 1:125,000.
No. 133. Ebensburg Folio, Pennsylvania. Scale 1:62,500.

The 26th annual *Report* of the Director (1904-5) includes the following maps:

Map of Alaska showing progress of Topographic and Geologic Surveys. Scale, 197 statute miles to an inch. Washington, 1905.

Shows the areas of topographical and geological surveys and reconnaissances and of special geological investigations prior to 1904 and the areas of the same kinds of work in 1904.

Map of the United States, showing areas covered by Topographic Surveys and the scale employed for each area. Scale, 230 statute miles to an inch. Washington, D. C., 1905.

This general map shows the condition of the topographical surveys to June 30, 1905.

Plates III-XXIV of this *Report* are maps showing the detailed distribution of the topographic surveys in the various States and Territories. On these plates are shown the sheets published to June 30, 1905, the sheets in course of publication, and the areas surveyed during the field season of 1904 and drawn in map form in the office season of 1904-5. The maps also show the areas in which precise or primary spirit-levels have been run and unmapped areas that are controlled by primary triangulation or traverse or by astronomical positions.

The total area of new surveys was 21,296 square miles. The total area surveyed in the United States to date is 955,996 square miles, or about 32 per cent.

U. S. HYDROGRAPHIC OFFICE CHARTS.

Pilot Chart of the North Pacific Ocean, May, 1906.

Pilot Chart of the North Atlantic Ocean, April, 1906.

The reverse of both charts contains brief rules for the use of oil to protect vessels in stormy weather, and also the testimony of many ship captains and others as to the favourable results that have followed the application of oil to calm the seas.

CANADA.—Ontario and Keewatin. Rainy River Sheet. (Standard Topographical Map, Sheet 27.) Scale, 1:500,000, or 7.8 statute miles to an inch. James White, Geographer, Dept. of the Interior, Ottawa, 1905.

Shows the projected location of the Grand Trunk Pacific R.R.

ARGENTINA.—Provincia di Córdoba. Scale, 1:2,500,000, or 39.4 statute miles to an inch. Roma, 1905.

Illustrates a report on the province of Cordova and its agricultural colonies in No. 22 of the *Bollettino dell' Emigrazione.* It shows how rapidly railroads have been making large parts of the colony accessible and the many settlements started in this growing agricultural region.

ARGENTINA, URUGUAY, AND PARAGUAY.—Eisenbahnkarte der La Plata-Staaten Argentinien, Uruguay u. Paraguay. Scale, 1:3,000,000, or 47.3 statute miles to an inch. Published by the Verein zur Förderung germanischer Einwanderung. Buenos Aires, 1905.

Shows in red all the railroads and the stations along them in the three countries, with insets of the cities of Buenos Aires, Rosario, and Tucuman and their surroundings and the ports of call in southern Argentina.

CHILE.—Magallanes-Senos Skyring i Otway i Canales Adyacentes. Scale, 1:250,000, or 3.95 statute miles to an inch. Oficina Hidrográfica, Valparaiso, 1905. (Price, $2.)

The explorations of which this chart is the fine result were made in 1904. As usual on these sheets, not only the soundings but also the altitudes of the bordering lands are very numerous.

CHILE.—Puerto i Entradas de Quellon. Scale, 1:75,000, or 1.18 statute miles to an inch. Oficina Hydrográfica, Valparaiso, 1905. (Price, $1.)

A resurvey of these waters on Chiloe Island.

ASIA.

ASIA MINOR.—Karte von Kleinasien. (In 24 Blatt. Scale, 1:400,000, or 6.3 statute miles to an inch.) By Dr. Richard Kiepert. Sheets BI, Aivalyk; CII, Afiun Karahissar; and AI, Titelblatt. Dietrich Reimer (Ernst Vohsen), Berlin, 1906.

Only four sheets of this important map, which was begun in 1902, are yet to come. Although in the present very imperfect state of the surveys it is impossible to make a fully satisfactory map of this part of the Turkish Empire, Dr. Kiepert has critically used all accessible material; and the large scale enabled him to present the topography with all the detail that our present knowledge justifies. Different symbols for town-marks indicate the population, and there are directions for the pronunciation of place-names. The German equivalents of many Turkish geographical expressions are given.

CHINA.—Postal Working Map. No scale. Inspector-General of Customs and Post. Peking, 1903.

Shows all the principal towns in China, distinguishing between those that are postal and those that are not postal. Symbols indicate the various kinds of postal communications, whether by courier, river boat, or railroad. The towns possessing direct postal facilities form only a small minority of all the towns.

CHINA.—The Shooting Districts lying between Wuhu and Shanghai. Together with a map of the Ningpo country carefully corrected and partly surveyed. Scale, 1:600,000, or 9.5 statute miles to an inch. By H. T. Wade, Shanghai, 1903.

A map of the regions south of the lower Yangtse, intended chiefly for sportsmen, and indicating in black type the districts where good shooting may be obtained. The map also gives much information on the distribution of the cotton, silk, rice, and other industries, and shows the waterways and other means of communication. It is accompanied by a pamphlet giving distances in Chinese li from Shanghai to various points.

EAST INDIES.—Ceylon. Scale, 1:760,320, or 12 statute miles to an inch. Published under the direction of P. D. Warren, Surveyor-General of Ceylon, Colombo, 1906.

Contains some information in addition to that issued by the Survey Department in 1904 (BULLETIN, 1905, p. 57), and is a more refined specimen of map-making. Though on a smaller scale, the facts are more clearly expressed. Colours are used with good taste to show the provinces.

AUSTRALIA.

NEW SOUTH WALES.—Geological Map of the Gerringong District. Scale, 20 chains to an inch. Surveyed by L. F. Harper. Department of Mines and Agriculture, Sydney, 1905.

Illustrates Mr. Harper's Report on the geology of this southern coal field of New South Wales, published in the *Records* of the Geological Survey of that State (Vol. VIII, Part II, 1905).

BOOK NOTICES.

Le Méxique au Début du XXe Siècle, par MM. Le Prince Roland Bonaparte, Léon Bourgeois, Jules Claretie, d'Estournelles De Constant, A. de Foville, Hippolyte Gomot, O. Gréard, Albin Haller, Camille Krantz, Michel Lagrave, Louis De Launay, Paul Leroy-Beaulieu, E. Levasseur, Le Général Niox, Alfred Picard, Elisée Reclus. 2 Tomes, 8vo. Paris, Librairie Ch. Delagrave (1904).

Two stately volumes, handsomely printed in large type, appropriately illustrated by many plans and charts in the text as well as by full-page plates, and a large topographical map of Mexico at the end, present to the public: "Mexico in the Beginning of the Twentieth Century." It is a meritorious effort, and reflects credit on the initiator, Don Sebastian de Mier, on Prince Roland Bonaparte and his collaborators. Not less than sixteen well-known political and scientific writers of France have, each, taken up a subject and treated it in the form of a monograph, while there is sufficient touch between the treatises to maintain logical sequence. Hence the work is divided into sixteen sections, seven of which (Introduction, Geography, Population and Colonization, Political Institutions, Agriculture, Mining, and Industry and Commerce, etc.) are contained in the first, the remaining nine (Railroads, Postal Service and Telegraphs, Coinage and Banks, Finances, Public Instruction, Sciences, Literature and Art, Army and Navy, Foreign Relations) and a Conclusion by Mr. E. Levasseur (who also has furnished the Introduction) form the contents of the second volume.

That the impression created by the present condition of Mexico is a satisfactory one will surprise nobody; nor is it to be wondered at, if the decided progress achieved by the Mexican people within the last twenty years is credited to the administration of General Porfirio Diaz. That progress is also (given the unquestionable merits of the Mexican President and of his advisers) largely due to the stability of direction insured by his maintenance at the head of the State; and it shows how much more beneficial such stability can become than alternate variations in policy brought about by party changes.

To do justice to all the sixteen chapters requires too great a space. We can only glance at some of them, and shall begin with Mr. Levasseur's Introduction. That introduction, as far as the historical part of it is concerned, is open to some critical observations. Thus the assertion that Mitla was destroyed in 1494 is by no means correct. The "Mictlan Quauhtla" of Mexican chronicles was not the ancient settlement of "Lyo-Baa," of the past of which there are as yet no authentic records. Nor is it apparent that the Mexicans were "from the earliest times on" builders of "lacustrian cities." The picture of the ethnologic status of the ancient Mexicans is also quite an antiquated one. In the same strain and in the spirit of hostility towards Spain resulting from lack of knowledge (of the nature of the Indian as well as of documentary history) the epoch of colonization is treated. It is the usual European standpoint deeply rooted in students of American antiquities and ethnology who, after the fashion of the French *émigrés,* have "neither forgotten nor learnt anything."

It is with some surprise that we meet, in the Aperçu Géographique of so distinguished a geographer as Mr. Elisée Reclus, statements like the following: (p. 42) "The Gila River, that flows from East to West towards the lower Colorado, divides the North-American mountains of Arizona and the Mexican ranges of Sonora and Chihuahua." As far as known, the Sierra Chihui-cahui and parallel chains, of considerable length and elevation, extend, in an approximately north-southerly direction, *between* the Gila and the Mexican boundary line, and they still are within the territory of the United States of *North* America. Nor is the term Sierra Madre applied to these ranges; it is confined to chains south of the frontier of Mexico. The section devoted to Hydrography does not contain palpable mistakes of a geographical nature, only that part of it touching upon the basin (Mr. Reclus justly remarks it is not a valley) of Mexico is disfigured by over-estimate of primitive Indian culture, marring the value of an otherwise very interesting chapter. It is almost comical to read, that the Chief of Tezcuco, "mourning wolf—Nezahual-Coyotl"—was a "very able engineer." The criticism upon Cortés for causing Spanish Mexico to be rebuilt on the site of the former Indian pueblo instead of the "lovely slopes" along the shore of the lake is simply childish. To cap the climax of errors, the famous tree of Santa Maria del Tule in Oaxaca is mentioned as a "sacred tree of the Tzapotecas," whereas it is established that, about 1675, there were four sprouts not over six feet in height growing around a spring, and that the junction of these into one trunk formed, since that date, the present giant. The village where the tree stands is called Santa Maria, not Santa Catarina, as Mr. Reclus (page 80) has it.

The section on Population and Colonization, due to the pen of Prince Roland Bonaparte, bristles with statements influenced by erroneous ideas touching the primitive condition and social organization of the Indians. To call the *Tlatoani,* or members of the tribal council, "feudal and hereditary lords" is only one example out of many. The romance built upon them is elaborately used, in explanation of the formation of "castes," in post-Columbian Mexico. The statement, (p. 89) "Moved by the narrow-minded patriotism and protectionism of the period, the Council of the Indies prohibited forever the access of foreigners to Spanish colonies," is correct, in the sense that such a prohibitory measure was indeed enforced; but it would have been proper to acknowledge that the incessant and unjustifiable aggressions upon Spanish colonies in times of peace, chiefly by the French in the sixteenth century, and later on by the English, compelled the Spanish Government to close its colonies to the subjects of other nations. It was a suicidal measure, but it was called for. We also have to take exception to the phrase (p. 89) that the Spanish immigrants, prompted by a spirit of local clannishness (*esprit de clocher*), were induced to form "a sort of clan." With the introduction of European ideas, the formation of clans was an utter impossibility. The section devoted to the Mexican mestizoes is remarkable for moderation of language concerning the Spaniards and for general truthfulness. The part dedicated to Indians contains a number of valuable (because true) statements, as, for instance: (p. 101) "It is not the sword of the conquerors that has caused the great losses of the Indian race, but the smallpox and the epidemics carried over from the Old World, chiefly those of 1545 and 1576." It should be observed, however, that the *Matlazahuatl,* which then decimated the population of the Mexican tableland, is an *indigenous* disease, forming a transition from the *vomito* of the coast to the typhus endemic in the Lake basin; it follows that the epidemics mentioned were not imported, but sporadic explosions, such as occur occasionally everywhere, and for which, as yet, no absolute reason has been discovered. Again, it is subject to proof that the number of Indians in Mexico *did not diminish,* but that, on the contrary, it *increased,* under Spanish domination. The settlements have been moved, and the composition of the residents of Indian extraction has changed, under the beneficial influence of *enforced peace,* which the Spaniards maintained between the tribes. Speaking of the Indians of northern Mexico, Prince Bonaparte makes the very just remark: (p. 105) "The misfortune of those poor peoples, as well as those of many others in both Americas, has been that the apostolic career of the Jesuits was interrupted too soon." The attempted justification of the Indian (p. 109) against charges of intemperance and superstition might well have been omitted, although there is a certain amount of (involuntary) truthfulness in it. The clinging of the Indian to his primitive rites is a feature resulting from the pre-Columbian condition, social but especially religious.

While (page 112) we meet with the novel and quite extraordinary statement: "Finally, several *thousand Yaquis* (italics are ours) from Sonora have emigrated to the North-American territory of Arizona, in 1902 and 1903," the chapter on Mormon immigration, on the other hand, is quite remarkable for the exact understanding of Mormon character and designs.

The chapter by Mr. Léon Bourgeois on Political Institutions is interesting for the questions between Church and State. Its author is certainly right in saying that there are Mexican statesmen (politicians would be a more proper term) who already regret the complete separation between Church and State. They probably realize that independence of the former deprives the State and its partisans of profitable control.

We can only recommend the section on Agriculture for its generally moderate tone and the wealth of useful information it imparts. Mr. Hippolyte Gomot proves in it that he has some practical knowledge of the aborigines, who constitute the bulk of Mexican land-tillers, when he says: "As for the aborigine, he destroys without thinking of the future; foresight is not a virtue of the Indian." Some old fables about the customs of primitive Mexico are, of course, repeated, such as that of the "Imperial Menageries," but they do not impair the general usefulness of the chapter. To any one interested in the agricultural resources of Mexico, consultation of Mr. Gomot's contribution is indispensable; and the same may be said of the one on Mines and Mining, by Professor de Launay, of the "École supérieure des Mines" in Paris. Abundant statistics accompany the texts. The first volume closes with Mr. Picard's chapter on Industry, Commerce and Navigation, in which, as an Introduction, the author informs us that the ancient Mexicans knew how to cut precious stones, and similar pleasantries. Casually, Mr. Picard alludes to the introduction of the printing press in 1535; the only mention, be it said, of that important event in the whole book. That introduction is placed, strange to say, to the exclusive credit of the printer, as if it had been his own initiative. We shall return to the subject.

The second volume opens with a most instructive chapter on Railroads and public works in general, by Mr. Camille Krantz. Like all of the other sections devoted to modern Mexican achievements, it is based upon elaborate studies of data.

In his treatise on Coins and Coinage, and on Banking, Mr. de Foville has displayed fair knowledge of an intricate subject. We have but to repeat this in regard to the chapter of Mr. Leroy-Beaulieu on Finances, in which Porfirio Diaz receives proper credit for the admirable manipulations through which his Government re-established the credit of the Mexican people in the markets of the world.

Mr. Gréard would have done well to investigate some matters alluded to by him in the section on Public Instruction. He should have studied what he calls "colleges and special schools for the children of Aztec nobility." He would have found that the *Telpuch Calli,* or Houses of the youth, were places where the young men of all the clans were instructed in the use of weapons and in some songs and folktales. It is quite surprising to find that, in the few paragraphs devoted to early Spanish efforts at education in Mexico, not a word is said about these early efforts having been made exclusively for the aborigines! These schools were established by Franciscans from then Spanish Belgium, among whom Father Pierre Van der Muir (Fray Pedro de Gante) was most conspicuous as teacher. The Indian children were taught to read and write, not only in Spanish, but in their own native idiom. *To extend this primary instruction* as far as possible *the printing-press was introduced.* Of that important measure Mr. Gréard says nothing; nor does he mention (possibly he is not aware of the fact) that it was the Viceroy of New Spain, Don Antonio de Mendoza and the first Archbishop, Don Fray Juan de Zumárraga, who managed to bring about the establishment of the printing firm of Juan Pablos (his name was Cromberger) at Mexico. He remarks (p. 160) that "the missionaries directed their efforts not only to those who were of European origin; they also looked after mestizos and aborigines." He should have said that the primary education introduced a few years after the Conquest *had in view the Indians exclusively,* and that education of Spaniards and half-castes was of later introduction. It would also have been worth while, instead of alluding to one of the pictorial *pater nosters* of Indian make, to mention the numerous catechisms in Indian languages that had been printed at Mexico previous to 1540.

The paper by Mr. Albin Haller on Sciences suffers from analogous inaccuracies, omissions, and misconceptions. Modern names, of mediocre importance, are plentifully scattered through its pages; whereas, with the exception of Hernandez, not one of the authors of the sixteenth century finds grace. It is true they were almost exclusively ecclesiastics. The chapter following, on Art and Literature, presents the same weak points. Nowhere is any mention found of the Indians who, issuing from the Jesuit College of San Pedro and San Pablo, composed long poems in the last quarter of the sixteenth century. Such efforts appear quaint to us now; they are "out of date," according to our point of view; still, they find their place in a review of Mexican literature, as well as the early poetry of any nation in study of its literature. What has been (no matter whether it pleases us or not) helps to explain that which is. In regard to the numerous historical works of an early date, there is a deplorable lack of mention, and for the numerous grammars and vocabularies in Indian languages, which are the basis of most philological and linguistic studies of our age on Mexican idioms, a complete blank is substituted. The chapters closing the work, on the

Army and Navy, on Military Law, Foreign Relations, and the General Conclusion by Mr. Levasseur, relate to present conditions, and can easily be controlled through official documents and modern statistics.

That the chapters are all equally well written is self-evident when we consider the literary standing of their authors. The unique faculty of agreeably alternating the necessarily dry with lucid expositions and explanation, for which French literature is justly renowned, impresses the reader throughout the work. It is greatly to be regretted that it is so frequently marred by lack of knowledge of the past and of practical acquaintance with the country and people.

A. F. B.

The Face of the Earth (Das Antlitz der Erde). By Eduard Suess. Translated by Hertha B. C. Sollas under the direction of W. J. Sollas. Vol. I, pp. xii, 604. 4 maps, 2 pl. and 48 text ill. Oxford, Clarendon Press, 1904.

The English-speaking world is to be congratulated upon being furnished with a translation into its own language by a master of geologic science of the classic work of the great Suess, father of modern physiography. Published originally in Germany in 1885, and later in a masterly French translation (1897), the first volume of The Face of the Earth has been familiar for years to the scientific public, and has had profound influence upon scientific thought and research. It would be a work of supererogation at this late date to undertake an exhaustive criticism of Suess's work, but a few words may be said to extend the knowledge of the clearest, the most instructive, and the most fascinating treatise extant upon the origin and history of the surface features of the globe.

The Face of the Earth epitomizes the work done in a century by scores and hundreds of geological observers, and even goes back to the beginnings of tradition, as well as history, in describing or tracing geologically recent changes in the configuration of our planet. Suess's work shows marvellous erudition and wide reading, but withal his statements are so well founded and his thoughts are so clearly and simply expressed that, in the words of another, "each fact becomes an argument, and the problems develop and in part solve themselves under the very eyes of the reader." The mode of presentation of facts and theories which characterizes and illumines The Face of the Earth cannot be considered unique, since it is employed in many treatises on geology and geography; but the master mind is revealed in the manner of applying the method to the earth as a whole, and in so marshalling facts in their proper relations and true proportions as to give a complete conception of the evolution of the globe, without striving to make the phenomena of nature conform to any preconceived or pet theories of the author.

One cannot appreciate the grandeur of Suess's work without knowing something of the preceding generalizations of Leopold von Buch and Élie de Beaumont, the appearance of which excited as much admiration in their day as has that of the work now under consideration in ours. Von Buch's theories have, indeed, been largely abandoned; but he first called attention to the relations between the great lines of volcanic activity and the grand systems of mountains, and he first introduced order into the study of the complex mountains of central Europe.

Geology has also outlived the geometrical earth-system of de Beaumont; but he was the first to show that the age of mountains could be determined, and that they were not all made at one time. Nor must we forget the work of other early masters of geologic science. Lyell added the idea of the permanence of the action of geologic forces, though he scarcely touched the fundamental questions of mountain-formation. Suess himself, in his preface to the English translation of Das Antlitz der Erde, refers to the proposition advanced by De la Beche in 1846 that "the foldings of the mountains of South Wales correspond to adaptation to a complicated lateral pressure," as being the real foundation and inspiration of his own work. Suess first made known the result of his studies in a little brochure entitled "Die Entstehung der Alpen" (The Origin of the Alps), in which one finds an advance statement of most of the ideas which have been so completely elaborated in his monumental work.

By a masterly array of facts, culled from all sources and thoroughly digested, Suess describes in broad terms in this volume several of the principal mountain-chains of the globe, the chief plateaux, and the mediterranean seas, comparing the features of one continent or province with those of another as critically as the explorations and reports would permit, since, as he says, the history of the earth is of fundamental importance in the description of the earth. He finds no evidence in support of the "elevation crater" theory of von Buch, and he determines the beautifully simple and mathematical geometric lines of de Beaumont to be equally contrary to the facts. All the phenomena show that in the surface of the earth we have to deal with a rigid crust which presents everywhere the results of accommodation to lateral pressure. The trend-lines of mountain-chains are seldom straight. On the contrary, they are, as a rule, curves of accommodation to lateral pressure, and sometimes they are strongly bent. The Alps, for example, yielding to pressure from the northwest, extend in a concave curve toward the Carpathians, avoiding the older Bohemian land-mass.

The last chapter of the volume sums up the comparative studies of the preceding portion of the book. It classifies the continental land-masses, aside from Australasia, which is not discussed for lack of data, into the units of (1) Indo-Africa, (2) Eurasia advancing toward (1) in a series of great folds, (3) South America, and (4) North America. Structurally the elevated land-masses may be separated into four principal groups: (1) the tablelands, or plateaux; (2) the horsts, or mountain areas, which have been left by the slipping down of surrounding portions of the earth's crust, (3) the folds, and (4) the volcanic mountains.

The stresses which result from the contraction of the outer part of the body of the earth are transformed into tangential folding and vertical subsidence. Many regions, like Indo-Africa, have experienced no kind of folding movement for a long time; but they have affected the advance of the great folded ranges, like those of southern Eurasia. Subsidence, or collapse, is to be seen much more widely, since at one time or another it has affected the whole surface of the globe. The mediterranean seas and the largest oceans owe their origin and enlargement to the subsidences, which have collected the waters together and permitted the continents to rise above the level of the sea, rendering possible the existence of animals which breathe by means of lungs.

The English translation by Professor Sollas has followed the original paragraph by paragraph and chapter by chapter, retaining the vivid personal style employed by Suess. Occasionally, indeed, the original has been followed too closely for the purity of the English diction. In fact, the only general adverse criticism that can be made regarding the work is that it is a literal translation and nothing more. The twenty years that have elapsed since the preparation of the original have seen many advances in geologic science, and the results of many valuable researches have been published, but these have not been referred to in any way in the work under review. When the French version of Das Antlitz der Erde was prepared, the references to important literature were brought up to date, with annotations, greatly enhancing the usefulness of the book. The English translation would have been much more acceptable and valuable had a similar plan been followed; had the meagre illustrations of the original been supplemented, as in the French edition, by some of the many that are available, and had the volume been supplied with an index. Both the German and the French editions lack indexes, however; but Americans, at any rate, dislike to hunt for particular items in such a vast storehouse of facts while waiting for years for the last volume of a series to appear with its general index. The English edition is good in that it has followed the French in putting the notes at the bottom of the pages to which they refer, instead of keeping them together at the end of the chapter, as in the original.

This English edition of Suess is a most welcome addition to the library not only of the geologist, but also of the general student of nature who desires to get a clear, broad conception of the surface of the earth. E. O. H.

A Home Geography of New York City. By Gustave Straubenmüller, District Superintendent of Schools, New York City. 12mo. Boston, Ginn & Co., (1905). (Price, 60 cents.)

This admirable text-book is planned to be given to children for the first book studied in geography. It gives the pupils of the Metropolis a clear, concise, yet comprehensive view of the great city in which they live. Every fact in the book should be known by every resident of the city, and these facts are presented so simply and logically that young children will probably be able to grasp and assimilate the material presented to them.

The book marks advance in the teaching of geography. The maps first studied are not those of the hemispheres, of which children know absolutely nothing, but of the school-room and the school-grounds, the parks, the city streets, with which they are more or less familiar. It is astonishing to find how little even high-school pupils know in regard to the geography of their own cities. There are many children living in New York City who have never seen the elevated railroad or a subway station. Many of these children will spend their lives within the limits of New York; and if this book is properly taught, it will undoubtedly be a valuable part of their public-school education.

The book is divided into two parts. The first part deals with Local Geography, and the second part gives Stories of Local History. The stories are so arranged as to lead the child through the paths of historical changes in as logical a manner as possible.

The book opens with exercises on the construction and reading of maps. Beginning with the map of the desk at which the pupil sits, this exercise in scale and proportion is developed through the school-room, the school-house, the school-grounds, the street, the nearest park or square, and finally leads to the reading of maps of various parts of the city. Maps of the city showing relief, physical features, political divisions, the harbor, etc., are given. Bird's-eye views are made a prominent feature, the author regarding them as most helpful devices.

The questions of transportation, manufactures, homes of the people, immigration, ferries, parks, museums, schools, churches, and libraries are considered and briefly discussed. The city government is taken up under the various heads: The

Mayor, the Borough, President, Board of Aldermen, Finance Department, Police Department, Fire Department, etc.

The historical portion of the book begins with the Indian boy and girl as they lived on the island of Manhattan at the time of the coming of the white man. Henry Hudson, Peter Stuyvesant, Nathan Hale, Alexander Hamilton, Robert Fulton, Samuel F. B. Morse, and Peter Cooper are considered with reference to the important work which each accomplished in the development of the city.

The author is to be congratulated upon having prepared a work fitted not only for the pupils of New York but for those of other places; for the plan may be used by teachers in any city. When pupils have thoroughly studied the geography of their home surroundings they will be better prepared to take up the study of other parts of the world.

It would seem wise to add a little more about the plants and animals to be seen in the parks, as subjects of special interest to children, and to include more exercises—that is, definite things to be done by the pupils. There are too few explicit statements in the text for the children, giving some short piece of work to be accomplished at some given time. F. P. G.

The Congo. A Report of the Commission of Enquiry appointed by the Congo Free State Government. iv and 171 pp. G. P. Putnam's Sons, New York, 1906.

This is a careful translation of the Report of the Commission which was appointed to ascertain if the natives in the Congo Free State had been subjected to ill-treatment by private individuals or by State agents, and to make suggestions as to methods of suppressing evils and promoting the welfare of the inhabitants. The Commission says that every possible facility and co-operation was extended to it during the four months of its investigations between Oct. 23, 1904, and Feb. 21, 1905. The conclusions reached and the suggestions submitted to the Congo Government have been briefly described in the press; but no paraphrase can take the place of the Report itself, which in several respects is very notable. The light it throws on the alleged Congo atrocities and the present condition of that territory, its value as a contribution to the literature of colonial government, and its acute and practical suggestions for the betterment of affairs which may have wider application than for the Congo alone, will make this little book a necessity in many libraries. It may be mentioned that the suggestions of the Commission are to be carried out, and that King Leopold appointed a committee to report on the best means of making them effective.

Senga Handbook. A Short Introduction to the Senga Dialect as Spoken on the Lower Luangwa, North-Eastern Rhodesia. By A. C. Madan. 100 pp. The Clarendon Press, Oxford, 1905. (Price, 2s. 6d.)

The Senga are a Bantu people, about 50,000 in number, living partly in British and partly in Portuguese territory on the lower Luangwa river, to the west of Lake Nyassa. This little book deals entirely with the Bantu forms and words used by that part of the tribe living in British territory.

Swahili (Zanzibar) Grammar. By A. C. Madan. 62 pp. The Clarendon Press, Oxford, 1905. (Price, 1s.)

Ki-Swahili is the *lingua-franca* of tropical East Africa, and Dr. Krapf and Bishop Steere years ago made the Swahili grammar accessible to all students.

The purpose of this short treatise is to show that the Swahili grammar is simple and easy to learn, and also that it is a useful introduction to the study of many other Bantu dialects.

Natal. An Illustrated Official Railway Guide and Handbook of General Information. Compiled and edited by C. W. Francis Harrison. xii and 300 pp., 4 Maps, 3 street Plans, many Illustrations, and Index. Payne Jennings, London, 1903.

Natal is one of the regions that have not yet been too much written about or over-photographed. There is, accordingly, much novelty for most readers in this volume which is both a guidebook to the country for the use of tourists and also a work of reference filled with information of a wide range. Few books are so profusely illustrated, and many of the views are very fine and do full justice to the beautiful scenery of Natal, its various activities, its inhabitants, and places of historic interest.

The Uncompahgre Valley and the Gunnison Tunnel. By Barton W. Marsh. 151 pp., Illustrations. Marsh & Torrence, Montrose, 1905. (Price, 65 cents.)

A description of this valley, hemmed in by mountains, in the extreme southwestern part of Colorado. It contains about 185,000 acres of irrigable land, and the small area that has yet been reclaimed proves to be remarkably fertile. The Gunnison tunnel and the subsidiary tunnels now building will undoubtedly help, in a short time, to turn the entire valley into a very fruitful region. The book was written to give information about this promising district, is attractively illustrated with half-tones, but, unfortunately, has no map.

Dictionary of Indian Biography. By C. E. Buckland. xii and 494 pp. Bibliography. Swan Sonnenschein & Co., London, 1906.

A volume of moderate size containing the chief facts concerning the lives of about 2,600 persons, living or dead, who have been conspicuous in the history of India within the past 150 years. Such a compilation, small in cost, cannot fail to be very useful wherever the public or press give any attention to the affairs of India. There is no similar work that is moderate in size and cost. Some omissions, especially among the Indian names, should be supplied in the next edition. The Swami Vivekananda, for example, has an adequate notice, but there is none of Ramakrishna, the founder of the Vedanta Philosophy, and of whom Vivekananda was a disciple.

New India, or India in Transition. By Sir Henry John Stedman Cotton. New and Revised Edition. ix and 252 pp., Appendix. Kegan Paul, Trench, Trübner & Co., London, 1905. (Price, 3s. 6d.)

This book is not geographical, but expresses the views of a gentleman who has spent many years in the Indian service as to the political, social, and religious changes that are taking place in India and the spirit which, in the author's opinion, should inspire British policy in relation to them. He discusses the opinions and aspirations of the natives, the increasing bitterness of race feeling, land and economic problems, social, moral, and religious tendencies, and other questions. He says that the gulf which separates the British from the Indians is widening, that the natives are practically excluded from participation in the higher official, industrial, and commercial life of their country, and that they demand a voice in the government of their own country and opportunities to engage in the public service. On the whole, the book is a criticism of the Anglo-Indian policy of governing India and of the attitude of the Anglo-Indian community towards the native peoples.

Sur le Yang-Tse. Journal d'une double exploration pendant la campagne de Chine (1900-1901). Par Félix Hémon. xv and 346 pp., Maps, Illustrations, and Index. Librairie Ch. Delagrave, Paris, 1904.

This book is interesting not only for its intrinsic merit, but also for the unusual manner of its preparation. The larger part of it is the work of a brilliant young Frenchman who was in the French Marine service and died at the age of 27, soon after his return from China. His diary and correspondence while in China contained a great deal of almost impersonal description of what he saw. It was freshly written with literary grace and in a vivid manner, and, on the whole, was very accurate. It was decided that this material was well worth publishing, and it is comprised in this volume, together with supplementary material of importance contributed by a few of Mr. Hémon's associates in the China campaign. These pen-pictures relate to the characteristics of the Chinese, their family and social life, their religion and education, besides other weighty matters, as well as lively descriptions of things seen on journeys up the Yang-tse and between Shanghai and Peking. The volume concludes with an historical and geographical bibliography of the Yang-tse region.

A Travers Sumatra. Par Fernand Bernard. 223 pp. and 52 illustrations from photographs. Librairie Hachette, Paris, 1904. (Price, 4 fr.)

The journey was from Batavia to Atjeh by boat, landing at ports on the southwest and northeast coasts of Sumatra. The crossing was from Padang to the Straits of Malacca, about midway of the island. The book is a series of pen-pictures along the Sumatran coast and through this middle of the island. The steamer from Batavia passed by Krakatau. Time and nature have repaired the wounds inflicted twenty-three years ago, when half the volcano was blown into the air. Vegetation, more abundant than ever, covers the sides of the great ruin of that day, native villages again cluster around the foot of the mountain among the cocoanut trees. The author saw and photographed from the summit the smoking crater of Merapi in the middle of Sumatra. He spent some time in the Atjeh country, where the long resistance of the natives to the Dutch rule has kept about a fourth of the island unexplored. In 1904 the pacification of the country was still far from complete, though Gen. Van Heutz had conquered the Atjeh Valley. A very good book as travel books go.

Everyday Life among the Head-Hunters and other Experiences from East to West. By Dorothy Cator. xiv and 212 pp., and 34 Illustrations from Photographs. Longmans, Green & Co., London, 1905. (Price, 5s.)

Mrs. Cator's honeymoon trip was from her home in London to the wilds of Borneo, where her husband was in the Government service. She says she knows nothing about "prehistoric and glacial periods" and "the subject of composed and decomposed porphyrite rocks and metamorphic states is unintelligible gibberish to me"; but she has really lived in some areas both of Borneo and

Africa where no other white woman has ever been, and she writes pleasantly and humorously of out-of-the-common experiences. Mrs. Cator was a woman of refinement living in a primitive sort of way and deprived of many ordinary comforts, and yet she was sunny and sanguine enough to be cheerful under most situations.

The Philippine Experiences of an American Teacher.—A Narrative of Work and Travel in the Philippine Islands. By William B. Freer. xi and 344 pp., 12 Illustrations, Map, and Index. Charles Scribner's Sons, New York, 1906. (Price, $1.50.)

Mr. Freer tells only of what he has seen and a part of which he has been. His narrative has to do with his personal experiences with the natives, from the Igorrote mountaineers of the north to the civilized Bicols of the south of Luzon. He had a large opportunity to study them well; for he was the teacher and adviser of many of them, and was brought into close dealings with them every day. Mr. Freer is evidently a man of sense and tact, and he is of the kind of American teachers who are highly praised by the Philippine Commission for the remarkable influence they have really exerted upon the natives. He shows the Filipino in his desirable traits and in his weakness, and demonstrates what the public schools are doing to fit the people ultimately for a fuller measure of self-government than they now possess. In connection with the fact that the school children are now learning to speak English, it is significant that the Spanish language is in no way their tongue, not more than three or four per cent. of the Filipinos being able to speak it. Each of the fifty or more tribes has its own Malay dialect. The author says the time is now ripe for the general introduction of such industrial instruction as has been given at the Manila trade school, where the instruction includes gardening, agriculture, carpentry, iron work, and housekeeping.

L'Italie Illustrée. Par P. Jousset. 703 pp., 14 coloured maps and plans, 9 black maps, 12 engravings, and 784 photographic reproductions. Librairie Larousse, Paris, 1905 (?). (Price, 22 frs.)

This quarto volume is a beautiful picture-book, and a very heavy one, because photographs fill fully half the space and heavily-sized paper is required to print them well. Both in letterpress and in picture the scenery, the ancient and modern monuments of art and architecture, the activities and the life of the people are graphically presented, although in a purely popular manner. The photographs are of the highest quality, which is all that need be said of the pictorial attractiveness of a volume devoted to Italy. The reproductions of Sella photographs, for example, appear to be fully equal to the originals. The plans of cities and ruins are excellent, but the coloured maps are not quite worthy of the encomium passed upon them in the preface. They are based upon detailed topographic surveys, and their scale is large enough for a true and fine generalization of the surface forms, but the work is much inferior to good atlas sheet standards.

The New Zealand Official Year-Book, 1905. By E. J. von Dadelszen. vi and 771 pp., Maps, Diagrams, Appendix, and Index. John Mackay, Government Printer, Wellington, 1905.

Gives in compact and well-arranged form a vast amount of information about the colony in so many of its aspects that nearly every one, from the merchant and mariner to the tourist and health-seeker, is likely to find in these official pages what he desires to learn about New Zealand. Here is a suggestive statement relating to the Maori:

> So long as the Maori kept to their originally-known colours—black, white and red—in the ornamentation of their houses and clothing the effect was harmonious and pleasing, but when they obtained European paints, dyes and coloured fabrics they were guilty of combinations of colour offensive to the cultivated eye.

Joseph Dombey. Sa Vie, son Œuvre, sa Correspondance. By Dr. E. T. Hamy. cx and 434 pp., Map, and Illustrations. (Librairie Orientale & Americaine.) E. Guilmoto, Paris, 1905. (Price, fr. 7.50.)

Joseph Dombey was a physician of the latter part of the eighteenth century whose attainments in archæology were considerable, though he was above all a naturalist. Turgot sent him to Peru and Chile especially to study their flora, and eight years of his life (1778-1785) were given to this arduous undertaking. Returning to France on the eve of her terrible period of internal political troubles, Dombey became involved in difficulties, and he died while yet he had published practically nothing. Dr. Hamy's book has been printed at the cost of several French societies in order to preserve the results of Dombey's scientific labours, which were found almost entirely in his correspondence. The recital of the main facts of his life and an appreciation of his work fill about one-fifth of the book, and the correspondence occupies the remainder.

Nordamerika. Von Dr. Emil Deckert. Second Edition. xii and 608 pp., 130 Illustrations, 12 Maps, and 21 Tables. Bibliographisches Institut, Leipzig, 1904.

In the first edition of "Allgemeine Länderkunde," the whole of America was treated in one volume no larger than this book, which is devoted to North America alone. This is one of many evidences that it is now more difficult than ever to generalize or summarize in short compass the accumulated information concerning our continent which the numerous scientific bureaux of the United States, Canada, and Mexico are constantly putting into book form. Dr. Decker wrote on North America in the first edition, and now, with twice the space at his command, and with richer materials, his book has a large variety of new contents, though its form and plan are unchanged. In undertaking such a task Dr. Deckert possessed the advantage of having travelled very extensively in North America and with the leisure to study its geographical and other aspects.

As the book treats of all phases of North American geography, none of the numerous topics can be exhaustively handled. What it does is to give a faithful picture of the continent in its most prominent organic and inorganic aspects; and in this we have seen no superior work.

A Book on Essex County, Mass.—Mr. John Henry Sears of Salem, Mass., has just illustrated the fact that there is opportunity for exploration at home. He has written a book "The Physical Geography, Geology, Mineralogy, and Paleontology of Essex County, Massachusetts," which will be of much value to residents of that neighbourhood. It is not often that we have an opportunity to dip into the earth studies with a book before us treating of the subject as far as it relates to our immediate surroundings. This is an advantage that the people of Essex County may now enjoy. They do not need to go outside of their own county for numerous illustrations of what the author is talking about, and they can form their own opinions as to his accuracy. Everybody in the county who is fond of mineralogical rambles should own this book, for it will guide him to the regions where specimens may best be obtained. There are over 200 half-tone illustrations, which help the text; and the book is one of the best local studies of the kind.

The Gambia Colony and Protectorate. An Official Handbook. By Francis B. Archer. xviii and 364 pp., 4 Maps, 45 Illustrations, and Index. St. Bride's Press, Ltd., London (1905 ?). (Price, 10s.)

A compendium of all manner of information about the colony, including its history from the day of Mungo Park to 1904. It shows the present progress of the people and their country in the various districts, gives an English-Mandingo vocabulary of about 800 words and phrases that are in common use, and presents a large amount of miscellaneous information of importance to all who have much to do with the Colony. The author says it is no longer true that three Governors are required for a West African colony—one dead, another acting, and the third on his way out. While Gambia is not yet an ideal health resort, disease has been fought there with a degree of ever-growing success.

Die Mandschurei. Übersetzt von R. Ullrich. 51 pp. and a Map. Karl Siegismund, Berlin, 1904. (Price, M. 1.)

This book is an admirable epitome of the geography, population, and economic condition of Manchuria at the time it was written. It was translated from the Russian "Material for the Geography of Asia" collected by officers of the Russian General Staff, and, like other works from the same source, it is a good piece of geographical writing. The pamphlet is short, and does not pretend to give anything more than what is necessary for a general knowledge of Manchuria.

Vom Heiligen Berge und aus Makedonien. Von H. Gelzer. xii and 262 pp., 43 Illustrations, Map, and Index. B. G. Teubner. Leipzig, 1904. (Price, M. 6.)

The author visited the Greek convents and a few famous old churches in Albania to study historical and other literary manuscripts of the past centuries which are preserved in these places. He improved the opportunity, also, to inquire into the present state and government of the convents and into the conditions prevailing in Macedonia. The result is a book that is rather out of the common in the material utilized, and gives many interesting facts, especially about the Athos peninsula, in which, in 1902, 7,522 monks of the Greek Church were living, more than half of them Russians, while most of the remainder were Greeks. The photographs help to give a vivid idea of these great religious retreats, and also of various phases of life in Macedonia.

Statistique Annuelle de Géographie Comparée. By Prof. Jean Birot. 32 pp. Hachette & Cie., Paris, 1905.

A well-arranged statistical handbook, in which each kind of facts for the various countries is grouped for purposes of comparison. In the table relating to iron, for example, the quantity, value, and mean price per ton, in certain years, are given for the eight chief producing countries. Another table shows the commercial movement in the principal ports of the world for the years 1901 and

1902. The world statistics, thus grouped, relate to population, the production of goods, fibres, mineral fuel and metals, and to commercial movement and military forces. The comparative idea is kept in view throughout, and the tables are very convenient and suggestive.

Le Rhône. Sa Navigation depuis les Temps anciens jusqu'à nos jours. Par Albert Breittmayer. vi and 105 pp. Henri Georg, Lyons, 1904.

A monograph written with enthusiasm and with descriptions somewhat too extended for foreign readers. The first steamer on the river was *Le Pionnier,* in 1829. It was a wooden boat, and took eighty-eight hours in ascending the river from Arles to Lyons. The six steamboats put into service in the next ten years did a large business both in the freight and passenger trades. The canal joining the Rhine and the Rhone had been opened, and the Rhone had become important in the trade of France, England, Holland, and western Germany as the great highway to Spain, Italy, and the Orient. Then dawned the era of railroads (1842). The navigability of the Rhone had been deteriorating, and little had been done to improve the conditions. The passenger traffic gradually ceased, but of late years the freight trade has shown some improvement.

Science in South Africa.—A Handbook and Review. Prepared under the auspices of the South African Governments and the South African Association for the Advancement of Science. Edited by the Rev. W. Flint, and J. D. F. Gilchrist. x and 505 pp., coloured Plates, Maps, Diagrams, Illustrations, and Index. T. Maskew Miller, Cape Town, 1905.

This Handbook on scientific work and progress in South Africa was prepared for the visit of the British Association in 1905. The two editors were appointed by the Colonial Governments, and the cost of producing the book was defrayed by the colonies. The volume, arranged in eight sections, deals with physical, anthropological, zoological, botanical, geological, mineralogical, economic, educational, and historical problems, and the contributors are actual workers in South Africa. The book shows the present condition of South Africa in respect of scientific research. It was useful to the British Association during its meeting, and will be welcomed by many others; for the scientific literature of South Africa, which has rapidly been increasing, is scattered through many volumes, some of which are difficult of access. This work will serve as an index to the whole subject of South African science.

La Belgique. Institutions, Industrie, Commerce. xx and 870 pp. Maps, and many half-tone Illustrations. J. Goemaere, Government Printer, Brussels, 1905.

This volume was published by the Ministry of Industry and Labor for the purposes of the International Exposition held at Liège last year. It is a summing-up of Belgium to the present time. It describes the kingdom in its geographical, political, and administrative features, systems of education, fine arts, sciences, agriculture, industries, and social organization. Nearly 300 pages are given to the industries and about 100 pages to commerce and communications. The book is profusely illustrated.

The Selkirk Range. By A. O. Wheeler. Vol. I. xvii and 459 pp. Appendices, Illustrations, and Index. Government Printing Bureau, Ottawa, 1905.

Mr. Wheeler and his assistants were engaged for two seasons in making a topographical survey of the portion of the Selkirk Mountains adjacent to the Canadian Pacific Railway. The ground was covered from the eastern to the western slopes and connected with the topographical survey of the Columbia valley and Arrow lakes. Thus a continuous zone has been surveyed for several miles on both sides of the railway and river, forming a base from which the work may be expanded in any required direction. The survey was especially needed, because the Canadian Alps are every year drawing a larger number of tourists, so that the demand for maps and accurate information is increasing. In the second year of the work the survey was extended southward, to embrace all previous travel and exploration of the higher Selkirk summits and make it possible to supply a reliable guide-map for tourists and mountaineers. Vol. II, containing the maps, diagrams and plates that are the result of this survey, may not be ready for distribution for some months.

The present volume is an official and valuable addition to our information concerning this wonderful mountain-country. It describes the survey and reviews the history of exploration and mountaineering in this region. Among the topics discussed in the appendices are notes on the zoology, ornithology, and botany, by Professor John Macoun; on the climatology, by R. F. Stupart; on the geological structure of the Selkirks, by the late Dr. George M. Dawson; a description of the railway through the range, by H. B. Muckleston; and an account of the discovery of Rogers Pass. The mountain views, photographs of mountaineers, and other illustrations are excellent.

Meteorologie und Klimatologie. Von Dr. Wilhelm Trabert. Large 8vo. Leipzig and Vienna, 1905. pp. 127.

The number of text-books of meteorology is increasing with some rapidity, but climatology has received little attention at the hands of any writer except Dr. Hann, whose *Handbuch der Klimatologie* must remain the authoritative work for years to come. Thus far, no attempt has been made to combine meteorology and climatology in one volume; but Dr. Trabert has undertaken the task, and has done it very successfully. Within the limits of somewhat over one hundred pages he has given an outline of the essential portions of both subjects. The first part is devoted to the meteorological elements, their measurement and reduction. The second, which deals with meteorology proper, presents the distribution of the different elements. The third part, on Weather and Climate, is the most distinctly novel. Beginning with a discussion of weather conditions and maps, and with weather types and forecasts, our author proceeds to give an admirable, albeit very brief, survey of the chief varieties of climate, and of the climates of different parts of the world. With the exception of Hann's famous *Handbuch*, there is no such clear, definite, serviceable treatment as that here given. Moreover, the *Handbuch* is very full; the discussion in Dr. Trabert's book is very brief. Our author makes no attempt to give an exhaustive account of the different climates. He gives for each climatic district a typical example, instead of trying to describe all the conditions in detail. We believe that this volume will meet a want which many teachers have long felt.

R. DEC. W.

OBITUARY.

Nathaniel S. Shaler.—Professor Shaler died at his home in Cambridge on April 10. He was born in Campbell County, Kentucky, in 1841, and at the age of eighteen was sent to Harvard, where he entered the Lawrence Scientific School. It was not long before his quick, keen, and versatile mind attracted notice. He studied zoology under Louis Agassiz, graduated in 1862, served in the Federal Army for two years and then returned, much broken in health, to Harvard, where he was appointed Instructor in Palæontology, and in 1869 became full Professor. He held this Chair to his death, but its title was changed in 1888 to Geology. He was one of the first American men of science to accept the doctrine of evolution, and Darwinism speedily prevailed at the Peabody Museum after 1873, when Mr. Shaler began to have a free hand there. He became Dean of the Lawrence Scientific School in 1891, and under his direction the school has grown rapidly both in numbers and efficiency. He devoted the last months of his life to the organization of the Graduate School of Applied Science, made possible through the bequest that the late Gordon McKay, at his suggestion, left to Harvard.

Mr. Shaler was a man of remarkable activity and productivity. In Harvard he was known as an able administrator, as a lecturer of unique gifts, and as a friend who kindled the interest, admiration, and affection of the students. His course in geology, known as Natural History 4, was the most popular in Harvard, and in his day it was taken by over 7,000 of the undergraduates. One of his students, now a Professor of Geography, writes to the Bulletin that "he was tremendously inspiring to all his students, and one of the select among those teachers who can really teach. He was versatile, suggestive, and human, and a gentleman of inborn courtesy." Besides his popular lectures he always conducted one or more advanced courses in palæontology, directed the summer school, carried the growing responsibilities of his deanship, was often busy with investigations and the preparation of reports for the U. S. Geological Survey, served seven years as Director of the Geological Survey of Kentucky and as a member of Massachusetts State Committees on Highways, etc., was consulted as an expert by many mining companies, and still had time to write voluminously and well. His literary products included some 25 or 30 volumes, besides unnumbered articles in magazines and scientific papers.

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THE FIORDS OF NORWAY.

BY

ALBERT PERRY BRIGHAM.

Nowhere can the geographer find a more intimate blending of land and sea than along the shores of Norway. Islands of rock, an innumerable advance guard, fringe the continent as it fronts those northern seas, and, through protected waters behind them, the Norse mariner pushes his craft as if in his Viking blood he had inherited a knowledge of these mazy labyrinths where the ocean plays hide-and-seek with the mountains. America has in good measure her counterpart where the traveller finds shelter from the Pacific between Vancouver and Alaska.

Behind the island ramparts of Norway the fiords pierce the land, twenty, fifty, one hundred miles; and being a narrow land at the best, one has visited the interior when, indeed, he has scarcely gone more than a day's drive from the sea.

We have made up our idea of a fiord from Norway as offering a type, the finest examples which the world affords. A deep bay, long and narrow, with steep and lofty walls—such is the fiord, an attenuated arm of the sea, shut in by mountains. Often the water is deep, as where, in the Sogne, the plummet drops nearly 4,000 feet. Add 4,000 feet of cliff, in fancy drain the fiord, and you have a cañon almost a half mile deeper than that incised in the Colorado Plateaux.

Scotland has its fiords, but the bordering mountains are not commonly so lofty or so bold; Maine has an elaborately-fiorded coast, and, if we could raise the altitude of her seaward lands from scores, or a few hundreds, to thousands of feet, we should have, in some measure, another Norway. Alaska is no doubt the best American copy of Norway; for there are found the ocean and the fiord, the lofty mountains and their snowfields, and glacial streams.

We may come nearer home, it is true, and find in the Hudson no mean example. Restore the ancient glacier, with its front at Peekskill, West Point, or Poughkeepsie, and we see the essentials of Norwegian geography. Pile four or five Palisades on each other, rear Storm King to a mile in height, send down ribbons of water from overhanging cliffs, deepen the waters at Newburg to three-fourths of a mile, and sprinkle the lower bay with mountainous islands, skirt the horizon with the midnight sun, and give the white man a thousand years of history, and you will have a Norway of your own.

This article will deal with geographic conditions rather than physiographic origins; yet a few words must be said about the causes of this indented shore-line. Some things we safely know. Here are mountains of crystalline rock shaped by the agents of destruction during long periods. That the coast has been upraised is plain to any one as he sees the elevated beaches and shore-cliffs, removed from the present operations of the sea. That the elevation just named represents but slight recovery from profound submergence seems equally clear. The pattern of the fiords is too intricate and tree-like to be due to deformation, shaping structural valleys; indeed, the foldings and crushings are so ancient that structural valleys would long ago have disappeared. Even the historian Professor Freeman speaks of "antler-like fiords," and thus points to the common-sense conclusion that these are river valleys made tidal by "drowning." Given mountains, plentiful rainfall, deeply-incised valleys and submergence, and we account for present arrangements, including the myriad islands isolated from the continent as the waters closed around rocky headlands.

The case is, however, not quite so simple; for many of the fiords deepen enormously after we pass their portals. Under the doorways, at moderate depths, are sills of rock or rock waste; then come long and narrow abysses until the water shallows again at the head of the fiord. The water in the outer end of the Sogne is usually less than 600 feet deep. Twenty-five miles from the entrance the depth is almost 4,000 feet. The Hardanger fiord is 1,500 feet deeper within than at its seaward end. This condition is repeated in Scotland, as where Loch Etive narrows at Connal Ferry and the rock-sill is so near the surface of the water that the ebbing tide pours over it in a boiling torrent. Within are 420 feet of water.

Raise Norway and long, deep lakes would replace the tidal waters in many fiord valleys. Ordinary streams do not scoop out such basins, and we seem driven to glacial ice, and to accept good measures of glacial erosion.

The glaciers are here, and the Justedal, covering 347½ square miles, is still a respectable ice-sheet. This and other ice-fields send down glacial tongues into the fiord valleys. These tongues have filled the valleys with ice of great depth, impelled by headstreams of ice pouring down slopes of exceptional declivity—in short, if we find the possibilities of glacial erosion anywhere we find them here. An English geologist has well observed that if the ice of Greenland were much reduced, that land would be as Norway is now. In former times, when Norway was as Greenland is to-day, the ice could exhibit its full power.

All the characteristic doings of ice are here—graven rocks, rounded domes, moraines, glacial cirques, and hanging valleys. These last, so fruitful in recent years in discussions of glacial erosion, seem more the rule than the exception. Everywhere are matured side valleys entering the trunk fiord valleys at heights of 300, 500, or 1,000 feet, and their streams have not had time to produce a recession of the falls whose waters leap abruptly into the fiords. Even the valleys joining the trunk valleys at tide-level would show vast discordance if the waters were drained out of the fiords.

All these conditions, with the profound basins lying within, as already described, force us, I think, to the conclusion that the deepening of these old river valleys is due to ice; and I believe this notwithstanding the magnitude of the work and evidences of slight glacial erosion in some parts of the fiords and of the valleys which succeed them at their heads.

In these very valleys, curiously near the head of many fiords, are deep lakes, separated from tidal waters by a short barrier of waste or of bed-rock and extending much below sea-level. These lakes are moraine-dammed, or in rock basins, and separated from the fiords, as the fiord lakes would, in case of elevation, be separated from the open ocean, by barriers of rock or rock-waste.

Norwegian scenery is ever recalling that of Switzerland, with this difference, that one can see so much of the Norse landscape from the deck of a ship. For days one follows the base of cliffs far higher and grander than those which arouse admiration for a short hour or two while passing the Highlands of the Hudson. The Swiss mountains are loftier; but they scarcely seem so, because their more ancient northern neighbours rise abruptly out of the sea. As in Switzerland, the fiord mountains, rugged as they are, cannot dissociate themselves from human life.

Follow the Hardanger northward toward Odda in the early morning. The mountains are 4,000 feet high, and on the steep lower grounds are dark forests and farms. Shifting cloud-masses brush the high slopes revealing, as they pass, bare brown cliffs, hanging glaciers, and fields of snow. Small streams tumble down the cliffs in ribbons a thousand feet long; and while the air is chilly with surrounding snows, the houses are many, with adjoining patches of meadow and small plots of potatoes, here and there a white church, and all looking down on the only highway, the waters of the fiord, here a hundred miles from the sea.

The Naero Fiord, a southern arm of the Sogne, meets all one's expectations of loftiness, of depth, of seclusion and gloomy grandeur. At every turn it would seem that the end has come; but in the nick of time a new vista is disclosed as one draws nearer to the heart of the mountains. Now the rocks standing sheer overhead four-fifths of a mile show gray and black and verdureless, and then appear the deep-green coniferous trees clinging to the cliffs or clothing the tops of vast buttresses that support the giant walls. Between these lofty buttresses are narrow lateral gorges or spreading glacial cirques, which give unending variety to the cliff forms that reflect themselves in the still, deep waters below.

A small ship may anchor its own length from the head of Naero Fiord and be in 20 fathoms of water. The path that leads by the edge looks into waters so abruptly deep that only expert swimmers could afford to make a misstep. Above, the rocky precipices are as various and delicate in expression as they are lofty and magnificent —sheer black cliffs alternating with slopes of forest green, of soft grasses and luxuriant trees, and within single reach of the eye not less than eight bridal veils of spray mark the lines where the melting snows on the plateau above pay their tribute to the sea.

In sailing up and down the fiords the physiographer observes the scarcity of rock waste—a strange fact, in view of enormous and prolonged destruction of the mountain masses. Where is the talus and where are the alluvial cones of giant size that ought to be here? The answer is in the steepness of the fiord walls. The waste of to-day has gone down into the bottom of the fiord, while the earlier débris has been pushed out to the borders of the ocean by the ice, and the rock-flour spread by the waves on the sea-floor. But once pass the head of a fiord and traverse its valley and the accustomed forms return—lofty taluses and great cones and fans from the ever-dissolving mountains.

The tales of travel and our preconceptions of more northern latitudes have distorted the common ideas concerning Norway, making it cold, steep, and repelling, save as the tourist or the man of science seeks his ends in midsummer. There is more verdure than one has thought, not less of rocky grandeur, but good measures of refinement and beauty in the landscape also, a country hospitable and gracious in its display of sublimity and power. Wherever there is found a square yard of glacial waste or weathered rock, there some seed gains a place, the prevailing moisture atones for the poverty of soil, and a tree waves its branches above the waters interlocking with its fellows to cover the nakedness of these northern mountains.

Everything east of the Mississippi save Niagara seems trivial beside the waterfalls of Norway—cold product of ice and snowfield, falling in silver streaks through dark-green woods and playing with the clouds which so often hang low in the abyss. It is apart from my purpose to say more of a descriptive sort. Let us ask what the geographic conditions are which Norway offers to human life.

First is the all-including sea. One cannot go far from it in that long and narrow land. And every land-locked belt of tidal water opens into that uncertain region where the Atlantic doubtfully merges into the Arctic seas. It is along the fiords that the people live. If they go inland it is by the unsubmerged parts of these great valleys. But more often the call has come from the ocean, and from safe harbours the Norseman has gone out to sail, to fish, to trade, to discover, to fight, or to find new homes. Whatever tonic of opportunity the sea offers, whatever impulses lie in its music—all the imaginings of world-opportunity that come over its waves from beyond the horizon—these have been the Norseman's heritage and the staple of his daily life.

Mountains are the second condition of Norwegian life. Indeed, the country is all mountain, with some parts reduced more nearly to base-level than others. The heights are comparable to the White Mountains, the Adirondacks, and the Southern Appalachians; but in their declivities and barrenness, in their snow and ice, they are Alpine rather than Appalachian.

Great Britain is most analogous of the countries of Europe; yet how diverse—her mountains less high, long free from perpetual snow or glaciers, and bordered by plains where the people and the sources of national life are found. Great Britain has sea and mountains; Norway has these only, and her people must be mountaineers, sea-faring though scores of thousands of them be. If you can imagine a composite of Switzerland and Holland, each bereft of its lowlands, you have left a kind of Norway.

A third geographic condition is climate, and we may look long to find a better case of agencies joining to produce it. Here we have high latitude, with its long winters and short summers. But we have also the proximity of seas well tempered by drift of more southern waters, and we have wide range of altitude. The mean temperature for January at Stavanger is 34.7° ; while for July the mean is 55.0° —a climate not excessively severe in winter and comfortably warm in summer. Norway inland is, indeed, colder; but the fiord waters, with their great depth, form a reservoir of heat and life which it is hardly too much to say has made it possible for the land to have a history. There is little in the fruit and vegetables of temperate latitudes which the short but life-giving summer does not produce; and Molde, on the north shore of its fiord, its slopes facing the southern sun and looking out across the waters on a splendid panorama of peaks and snows, is famous for its roses. Could we imagine the fiord topography transferred to the tropics what should we see? We can picture the glory of tropical vegetation on those rocky walls, but it might be less than the majesty of the dark-green firs. We could not have the snows and waterfalls unless the mountainous plateau were vastly higher, and these secluded valleys would be insufferably hot. But why imagine, when fiord lands, at least in their typical display, seem confined to higher latitudes and to the fields of glaciation?

Norsemen get on well without a tropical sun, ripen wheat within the Arctic Circle, hops at Loffoden, and cherries in north latitude 66 degrees. Doubtless psychological effects not measurable in a laboratory have accumulated through centuries of inheritance under the subtle influence of the absence or presence of light in the long winter nights and unending summer days of that land. The summer sun sets at no early bed-time and rises long before the most enterprising farmyard monarch in America sounds his call to day. And in the hours called by custom night the sunset glow follows the horizon and mingles with the dawn.

Geographic position is the next element in Norwegian life. Peninsular as she is, she is more isolated from the continent than insular England. Yet she has had her hand in some true way in the affairs of Europe, because her fiords led out into the "broad, public highway of the Almighty." Her people have been less set apart than the mountaineers of Switzerland, even though the Alps have been in the track of great nations for twenty centuries.

The final item in the geographic conditions of the Norsemen's land is the limitation of its resources. Just so much can you get out of it and no more. Whittier writes—

> The frozen fiords were fishless,
> The earth withheld her grain;

and Björnson in plain prose reveals the habit of the farmers to expect one bad year, and sometimes two, out of every five. The stones and trees make it a burden to open new land, and on many slopes it is hard to keep the thin soil at rest. The wild torrents from the mountains have to be controlled where they cross the fields, and on such grounds primitive hand labour must ever be done.

The population, therefore, cannot pass a certain point, and is to-day in density the smallest in Europe—16 to the square mile, though even this is large when we remember the lonely wastes of most of our Cordilleran States. A sturdy type develops here, but cannot multiply, and the corollary is overflow, emigration. Thus it has ever been, from mediæval to the latest modern day—the Viking of old and his more quiet but equally blond sons of the twentieth century.

"I do not think," says Björnson, "there is any other nation which travels so much as my countrymen—as sailors to all parts of the world, as fishermen on their great fishery and whaling expeditions, as artisans, students, or men of science seeking knowledge and experience abroad, as merchants seeking new markets, and last, though not least, as emigrants."

Such is the environment of man in this northern land, with rugged mountains, omnipresent sea, circumscribed resources, and isolation which has nevertheless invited fellowship with the world.

Let us turn to Norwegian industry. Think of a country that has but 740 square miles of ploughed land! More, indeed, might be tilled were it not needful to keep it in meadow. In some places the Norse farmer has actually carried back to overlying slopes the soil which rains, in the process of tillage, have swept down upon the lower fields. No crop seems more luxuriant than potatoes, seen in garden patches, planted in rows not more than twelve or eighteen inches apart, and covering the ground completely when midsummer has come.

No agricultural process is of more interest than the haying, The dairy is the staff of life, and scythes, like a small sickle or a corn-cutter, are carefully wielded over rough and hummocky ground where the American farmer would turn loose his sheep. Yet in the better meadows the growth is rank and full, not tall, but soft, thick, and fine, and matting so close that there is added reason for drying, as the people do, upon hurdles or trellises. Much too moist are the air and soil to cure grass in the way of other latitudes. It would become fertilizer rather than forage if left to cure on the ground. On the hurdle, its fine texture turns the rains effectively so long as sun and air need to continue their work. Thus haying proceeds along the fiords, while the saeter, the mountain dairy, is in operation on the heights, whither the cattle and the dairy maids have migrated for the summer period.

Sometimes from these heights a taut wire is stretched to the homestead below, down which, three thousand feet or more, the products of dairy and forest are transported. I did see haycocks at Oie in American fashion, and there are mowing machines in Romsdal; but, in great part, the cow standing docile in a small boat crossing the lake at the head of the Hardanger is a type of the primitive life of man and beast on the farms of Norway.

Let me classify the arable lands along the fiords with reference to their origin. Some fields are due to differential weathering, where rough and craggy ridges come down the mountain-side to the water's edge, and between them, on the waste of softer rocks, are irregular lanes of fresh green flecked with white cottages. At the heads of the fiords deltas may be found, though the depth of the water makes the land-growth of the delta small. More favourable are the heads of the lakes for delta expansion; and where a lake intervenes but a short distance from the head of the fiord it pockets the sediment and sends the waters of the valley into the sea free from waste.

As in our own northern States, filled lake-basins abound, with meadows and fields. Other physiographic forms whose surfaces are used by the farmer are the alluvial cones, slopes of talus, and the ordinary flood-plains. There are delta terraces also, marking the level of lateral discharge into the fiords in the more submerged state of the region; also glacial moraines, sand-plains, terraces, and valley trains.

Another product of differential weathering—or, perhaps, sometimes of differential glaciation—is found in the lofty shoulders of rock, on which, far above the sea, on dizzy perches, farms are placed, seemingly inaccessible. The floors of matured lateral valleys also, whether now hanging or at the present base-level, offer another foothold for the home-maker and the tiller of the soil. The elevated strands, as at Aalesund and many points in its neighbourhood, contributed soils to the land in the time of their uprising.

I have consulted no statistics to learn the relative importance of Norwegian industries. But the commerce is not small; for though the land has not much of its own to transport, its people take rank among the great carriers of the world.

Perhaps the railroads are the least important factor in transportation, and they seem, even prospectively, of less account than the Government highways, built with infinite toil, under the direction of skilled engineers, inward from every fiord head, toward the capital.

The water is the Norse road: children go to school by it, wedding parties go to the church over it, the farmer goes to market upon it. Mail steamers thread the watery mazes everywhere, and where they cannot come up to a pier, a small boat puts out at morning, or noon, or in the twilight of the night, to send to Bergen or some far-away port tubs of butter or boxes of fish; and if the fish is too long for the box, it is small matter, for the tail sticks out, while the cover is nailed down, and somebody is fed from the nourishing waters among the mountains.

Old and young are accustomed to the water. The children might as well have been born upon it, so much at home are they with rowing craft; and I have seen young girls with unconcern gathering berries on the brink of a precipice. Neither young nor old have learned to be "afraid of that which is high"; they take their country as they find it, summer sun and winter snow, and make the remotest strand the centre of the world, though sunk so deep in the mountains as to seem lost to the outer life.

The Norseman has never failed in his mastery of the wild nature in which he lives, and the inheritance of a stern and stormy zone seems to appear even in the slow farmer boy, who, with his yellow horse and harness of rotten cord, runs you down at breakneck speed along the edge of cliffs, scaring you to desperation, but bringing you safe to the foot of the mountain. No doubt a cautious New England driver would break the harness, overturn the vehicle, and bring you to disaster. There is something to warrant Boyesen's picture of the "tall, blond men with defiant blue eyes who obeyed their kings while they had confidence in them and killed them when they had forfeited their respect."

There are harbours everywhere, and every fiord mouth has been for ten centuries a challenge to see the world. It was inevitable, therefore, that Norsemen should breathe the ocean air and go forth. Their errands have accorded with the stage of civilization which, century by century, they have attained. And they have thus crossed the sea for discovery, for robbery and conquest, for commerce and for new homes. They are strangers to no land where ships may come;

> The wolf beneath the Arctic moon
> Has answered to that startling rune;
> The Gael has heard its stormy swell,
> The light Frank knows its summons well;
> Iona's sable-stoled Culdee
> Has heard its sounding o'er the sea,
> And swept with hoary head and hair,
> His altar's foot in trembling prayer!*

Nearly all the towns of Norway are on its fiords, and often at their heads. Such are Christiania, Bergen, Trondhjem, and smaller tourist places, as Odda, Gudvangen, Merok, Helslyt, Naes, and many others. On or near the open ocean are such busy fishing centres as Aalesund and Christiansund.

With farming and carrying, fishing finds a normal place; for thousands of men till the soil in the summer and man the cod fleets in the winter months; or the women may manage the farm, maintaining independence and vigour while their husbands are far off along the coast courting danger and gathering the harvest of the seas.

Not all the fishing is done in distant seas; for on the dusky water of the fiord in a summer night, under the shadow of the inclosing mountains, you may descry a little fishing fleet, each boat bearing an oarsman and another standing with the line. The Norwegian will fiddle at the top of the salmon stairs, and apparently await his catch with the same philosophy which belongs to the fisherman of all times and all lands, and when one visits the fish markets at Bergen on Saturday morning and sees on the public square the quietly-chaffering throngs of common people, and looks over upon the small boats that crowd the wharf, filled with innumerable fish, he has perhaps seen the most typical exhibition of human affairs in all Norway.

Agriculture, fishing, and commerce—these are the resources. Agriculture is at its limit until the mountains waste away or an uprising continent lays bare the submerged ruins of northern Europe. The seas are fruitful, and a stable but moderate wealth will always be drawn from them. Perhaps, too, Norway can own more ships, and lure thus the world's money to support a larger population. One thing she could do if she could get at the raw materials of manufacture: her falling waters would propel the wheels of all the civilized industry of Europe and America if they could be utilized. Perhaps we shall have no regrets if somewhere nature cannot be put in harness. When Niagara has gone dry and our Atlantic States are no more the home of unpractical and idealistic sentiments about the natural world, an increasing number of unpractical men and women will go over the sea to find yet a land where nature is unspoiled and where syndicates have not acquired title to the rights of the soul.

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* Whittier's "The Norsemen," a poem on the visit of these mariners to New England.

Will Norway lose her charm for the lover of natural scenery? And will her people be brought into monotonous uniformity with the conventions of modern civilization? No measure of natural splendour will eliminate the shallow tourist and bring to those great scenes only those who are prepared to appreciate them. There is no law to forbid the American tourist from rushing on deck as you are sailing in the early morning up that fine watery path to Odda and crying in your ear, Where is the end of this "ford"? and, What is there to do at "Oddy"?

Edmund Gosse, revisiting Norway after a quarter of a century, saw many changes; but he did not think the land could easily be spoiled. Much of it can never be anything but wilderness; for the "spirit of its landscape is as untroubled by satiety as Shelley's skylark." But Norse character—will it be spoiled? It is a surprising experience to pull up at the docks of a city of 70,000 people, let down the gang-plank, and see many hotel porters and cabmen, in perfect and pleasing silence, refusing, even if you wait an hour to come on shore, to solicit a job at your hand. Forty years ago it was the same, and sturdy hackdrivers smoked their pipes with a philosophical indifference not easy to understand. Gosse explains it as a kind of shy defiance, shown by men who will not be patronized but will stand on their native dignity.

With this simplicity are many tokens of modern life. There sounds the gong of electric cars, and the sign "holdplatz" abounds. There is machine typesetting in Trondhjem; and I have not heard that there are strikes among the operators. Aalesund was burned, and its wharf is as busy and dirty as any latitude can show; while a professional diver goes up and down, laying a foundation for a new pier wall. At Bergen is the ubiquitous "Berlitz school"; and the Mutual Life of New York, "Stiftet 1843," is announced by a sign of twenty-four letters in one word, which would baffle any Yankee tongue. The dog looks into a gramophone, the "Circus Norbeck" goes on in its career of popular amusement, and the Grand Café tries our notions of primitive simplicity, with its gilded ceiling, dress coats, orchestra, its many courses, numerous wines, and parlours with palms and paintings.

But the influence of the land will not fade. Norwegians cannot become a race of effeminate men. It has been said that to name Björnson in any assembly of Norsemen is like running up the national flag. His own lines have become the national song, and such they are because in them Nature sounds her call—a call which must fill the native ear and re-echo in the heart:

> Ay, we love this land of ours,
> Crowned with mountain domes ;
> Storm-scarred o'er the sea it towers
> With a thousand homes.
> Love it as with love unsated
> Those who gave us birth,
> While the saga-night, dream-weighted,
> Broods upon our earth.

Here is a people wonted to solitude, each household turning up the stony soil beneath the overhanging mountains, and often they must sail their boats up or down the long fiord to find a neighbour. Peaks, glaciers, snows, clouds, and blue waters have written themselves in unconscious lines upon the heart, with impressions too deep to be effaced or forgotten. They are an intelligent people, and know the history of their lonely North. Still they write the reminders of the past upon the ships that sail to-day, and the breath of the north wind is not far away, even in busy Bergen harbour, when you read—King Erik, Kong Halfdan, Vikingen, Raftsund, Sverrie Sigurdsson.

Thousands have made their home over the sea; but they do not forget. The spell of the land is on them—the aurora, the long summer day, the calm winter night, the small tillage and frugal ways, the mountains, waterfalls, and the sounding sea: these join in reactions which no chemistry can follow to turn the Norsemen in wild fancy, if not in bodily presence, to the land that bore him, reared him, and made him her own:

> There's a land where the snow is eternally king,
> To whose valleys alone come the joys of the spring ;
> Where the sea beats a shore rich with love of the past,
> But this land to its children is dear to the last.

THE MISSISSIPPI RIVER AS A TRADE ROUTE.*

BY

ROBERT MARSHALL BROWN.

The history of the Mississippi River as a highway of commerce, like the history of many enterprises and nations, shows a period of rise, a period of maximum importance, and one of decline. The curve which could represent its variations would not be a regular one, but would display numerous interruptions, the expression of a temporary impetus given to traffic by certain combinations of favourable circumstances, or of a reversal in the progress of trade. During the middle third of the last century the traffic along the river increased rapidly. No competitor to the river as a path of travel and transportation between the interior and the Gulf seaboard existed. Towards the end of this period a reality and a superstition checked the growth of the river transportation. A railroad to New Orleans, constructed about the year 1865, opened another route to the Gulf, and turned some of the products of transportation from the old river route. At nearly the same time there seems to have been a belief among the merchants and traders in grain that the transit of grain through zones of warmer weather was injurious to that staple. During 1869, the St. Louis Grain Association determined to test the sense of this belief, and planned to ship a cargo of grain to Liverpool each week during the summer. About 500,000 bushels of wheat were shipped, and arrived at the port in good condition. As far as the climate was concerned, there was no longer a barrier to the shipment of grain *via* the Gulf. The cost of transporting, loading, and unloading, and the rate of insurance for a cargo from St. Louis to Liverpool, were reckoned at $.37 per bushel—about the same price as is recorded to be the rate, now, from Dubuque to New York *via* Chicago. Another event which made these years a transition period in shipment was the change in the manner of transportation along the river itself during the years 1867 to 1869. The old manner of shipment by steamboats, as they chanced to come along, was uncertain, and it was also laborious. It was necessary to put the grain in sacks—in part to expedite the loading and unloading, but largely because the storage conveniences of the river boats demanded it.

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* Compiled in part from the Reports of the Mississippi River Commission.

About this time barge lines began to be organized, and the shipment of grain in bulk was made possible. The towing of several barges filled with wheat and hastening to New Orleans gave added dignity and a new importance to the grain route down the Mississippi. Notwithstanding all this, during the years which followed, when the shippers were free from the superstitions of the warmer zones' effect on the grain and with the increased possibilities of river shipment, much of the grain was freighted overland from St. Louis to New York and there loaded for foreign trade. The shallow water in the distributaries of the river, which did not allow vessels of over 15-feet draft to enter the Passes, was detrimental to the Mississippi as a highway for grain. The St. Louis Grain Association, in proving the worthlessness of the fear of a warmer climate, demonstrated that, on account of the small depth of water in the Passes, the river port could not compete with any show of success with the cities along the Atlantic seaboard. In 1879, Captain Eads, by means of the jetties in the South Pass, secured a deep-water channel which allowed the passage of vessels of 26-feet draft. Now began another period in river transportation. A very large increase in the total number of bushels of grain exported by river in the two or three years following 1879 is recorded. In 1880, one-third of the total grain shipments from St. Louis was sent down the river. For 1879 the percentage was 18.

An interesting compilation in the form of a table is printed in the Mississippi River Commission Report for the year ending June, 1901 (p. 38). This table shows the character and amounts of the river business for the port of St. Louis during the years 1865 to 1900, inclusive. There has been during these years a rather persistent decrease in the amount of river traffic. The number of boats arriving at St. Louis in the five-year period from 1896 to 1900 was 31.6 per cent. less than for the five-year period from 1865 to 1869. There is also shown in the table a decrease of 39 per cent. in the total tonnage of freight, received and shipped, from the five-year period 1871-1875 to the five-year period 1896-1900. The ratio of the river traffic in grain to the entire grain traffic shows many fluctuations. The percentages of the year 1881 (37) and of 1880 (32.6) marked the upper range. These are much in excess of the other years, and record the first rush of traffic following the location of the jetties. For 1900 the percentage was 6.4. Since 1876 but two years show a smaller percentage—5.4 for 1899, and 5.7 for 1895. The freight rates per bushel of wheat, from St. Louis to Liverpool *via* the river and New Orleans and also between the same points *via* New York, are tabulated. These rates cover the period from 1883 to 1900. The river-route rates range from 19.6 cents in 1883 to 11.64 cents in 1894. During 1900 the rate was 14.64 cents per bushel. The route rates *via* New York ranged from 27 cents in 1883 to 18.41 in 1900. It is noticeable that the differences in the rates for the two routes have grown persistently less during this period; and the least difference in any year of the record was in 1900—a difference of 3.77 cents. It may be that this lessening difference in transportation rates is a reason for a portion of the decrease in river traffic. The difference in price between the two routes may now be so small that it is counterbalanced by the difference in time. The discussion of the table in the Report ends with this statement:

> On the whole, the decline in volume of river traffic at the port of St. Louis has not been as great as commonly believed, and is still a very important factor in the problem of cheap transportation, which becomes more and more imperative as margins of profit in trade and manufacturing grow smaller. The inevitable result must be an increasing use of the river as a commercial highway.

There seems to be no warrant for the optimism of this last sentence, except the tendency of men to see things as they want them to be.

It has been shown* that during the ten-year period from 1890 to 1900 there has been a gain in the total tonnage of vessels entered and cleared at the port of New Orleans. This gain amounted to 66 per cent. In this same ten-year period seven Atlantic ports show a gain of 48 per cent., and five Gulf ports a gain of 111 per cent.

> The absolute gain of the vessel tonnage of the seven Atlantic ports named was 2½ times the absolute increase of the tonnage of vessels that visited the five Gulf cities, but the percentage increase of the Gulf ports was 2⅓ the percentage growth at the Atlantic cities. . . . There is no probability that the Gulf cities will ever surpass the North Atlantic cities in the total volume of trade, but the redistribution of American trade now in progress will give the Gulf cities a greater share than they have had or now enjoy.

During the same ten-year period that yielded a gain in the commerce of New Orleans of 66 per cent. there was a loss of river shipments at St. Louis of 60 per cent. St. Louis is not the only port along the Mississippi River with traffic connections by water with New Orleans; but inasmuch as it is the dominant centre of the Mississippi Basin, any loss in its river traffic must reflect a similar loss in the total sum of river traffic. The gain of 66 per cent. at New Orleans could not easily result from an increase in the traffic of other riparian ports while the percentage of loss at St. Louis was so large. A tabulated statement of the traffic passing the port of Louisville, Kentucky, on the Ohio River, is published in the Reports of the Mississippi River Commission (1901, 40). The year 1900 showed a loss of 40 per cent over the year 1890 in the total amount of freight of all kinds. From 1880 to 1890 there was a gain of such moment that the five-year period 1896-1900 shows a gain over the five-year period 1880-1884. The movement towards New Orleans, in other words, must be an overland traffic at the expense of the river line. Whether this decline in the river trade will persist or whether some new feature in the future will restore to the river its prestige is problematical. The railroad lines to New Orleans, which even now promise to be more numerous, are likely to be persistent and damaging competitors to the slower and more uncertain waterway route. Several factors, however, are making for an increased use of the river as a highway:

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* Johnson, E. R. Report of the Eighth International Geographic Congress held in the United States, 1904, p. 817.

1. The maintenance of a low-water channel. In 1896 the project of sustaining dredges which should operate during the low-water season from July to January was adopted. It was the plan to maintain a standard channel of 9 feet of depth, and with a width of 250 feet, from Cairo to the Gulf. During 1899 a navigable channel of 8½ feet was maintained from Cairo to New Orleans. This work was accomplished easily by five dredges, one or more of them being in operation from August 11 to November 26. The engineers in charge of this work have concluded that the successful opening through a bar depends largely upon two factors, only one of which it is in their power to control. The factor that is beyond their control is the water condition presented by the season. If the stage of the river remains constant or steadily falls, a good channel, once opened, will remain good. If, however, there is a rapid decline in the stage of the river, the increased deposition of sediment is liable to refill the channels. The second factor is the skill with which a location is made. If a channel is located on lines that coincide with a river crossing, the river will probably assume that direction and improve the channels. With a bar blocking the river crossing and diverting somewhat the position of the thread of the river, considerable skill is demanded in determining the proper location for the channel. During 1900 a channel of 10½ feet was maintained; during 1901, 9 feet; 1902, 9 feet; 1903, 9 feet until December 5. The low-water seasons of 1903 and 1904 show some interesting comparisons. The high water of the spring of 1903 was expected by the engineers to produce an unfavourable effect on the low-water channel. As the amount of sediment a river can carry depends largely on its volume and speed, it was natural to suppose that on the decline of an excessive flood more obstructing bars would result than during a season of lesser flood. The 1904 flood was a flood of almost equal magnitude to that of the previous season; but, follow-

ing so closely after the 1903 flood, its importance and destructiveness suffered considerably by arriving before the river conditions and the riparian dwellers had become wonted to lesser heights. The conditions following the floods were, however, very diverse. The decline of the 1903 flood was a gradual one; while that of the 1904 flood was sudden. The result of these two conditions on the amounts of dredging is marked. No dredging during 1903 was necessary until about December 5; during 1904 dredging was begun about August 22. In the latter case a low stage was reached early in the season. On August 22, when dredging began in 1904, the river had fallen at Vicksburg 23 feet since July 24, or from 54 feet to 31 (Natchez datum). During the same dates of 1903 it fell but 2 feet, or from 41 feet to 39. The dredging height, 31 feet, of the season of 1904 was not reached during 1903 until November 25. So open was the river during this latter year that the engineers became over-confident and considered their work for the season done. This resulted in the stoppage of navigation earlier than is customary. A combination of circumstances, growing, mostly, out of relaxed vigilance, coincident with the sudden fall of water early in December, put a stop to navigation. The engineers account for this failure to keep an open way by the following reasons: The season was considered closed, there was a scarcity of coal, numerous accidents occurred, severe storms and freezing weather followed. Such experiences are salutary in the long run, in that as a result of them recurrences are the more carefully guarded against. However, during a limited time subsequent to the disaster such relapses of the river tend to decrease the confidence of the navigators and shippers in the work that is in progress.

2. The survey for a 14-foot waterway. The River and Harbor Act of June, 1902, provided for the consideration of a waterway 14 feet deep, from the mouth of the Illinois, *via* the Mississippi, to St. Louis, in connection with a 14-foot waterway from Lockport, Illinois, to St. Louis. An examination and investigation is now in progress; plans are being prepared, and the cost estimated for such a course. It is likely, in case such a course is declared feasible and put in operation, that some addition, not large, to the traffic of the Mississippi River will result therefrom. In this same connection, Miss Semple* states that a proposition was recently made to the United States Government by the president of a large railroad system having its terminus in St. Louis that the Government im-

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*Semple, E. C. American History and its Geographic Conditions. 418.

prove the Mississippi River so as to secure a 12-foot waterway from the mouth of the Missouri to New Orleans.

3. Opening of the Panama Canal. It is not unlikely, with the redistribution of commercial activity in favour of the Gulf cities, and the possibilities of an Isthmian canal, which may further increase the importance of these cities, that an impetus may be given the river traffic and the decline in its freightage be checked.

Over against the items favourable to an increased river traffic may be placed the tortuous path of the river, the uncertainty at both the high and low water stages, and the slowness of river traffic in general. The distance from St. Louis to New Orleans by river is over two and a half times the mileage by rail; and this added to the slower rate of water traffic accentuates the difference in time. The ratio of time by land and by water is about as 1 to 10. During the year traffic is liable to be blocked through various contingencies. The winter season may be cold and icy; during the high water of the spring months, when the levees are full, the boats may be ordered to move at reduced speed, so as to prevent the wash of waves against the levees; and during the summer and fall some uncertainty may exist concerning an open waterway. An indication of the tendency of the times may be read in the retirement from business of the St. Louis and Mississippi Valley Transportation Company, which had been for years the principal carrier of grain and other freight between St. Louis and New Orleans. The Monongahela River Consolidated Coal and Coke Company purchased their entire equipment of three large tow-boats and thirty barges.

It must not be understood that the traffic of the river has declined beyond the point where the outlay for improvements of the navigability of the stream is not fully compensated by use. It is not the expectation that the decline will ever reach such a point. The river will, probably, always be a factor in the commerce of the Valley, although it is improbable that it will ever again attain to paramount importance.

Worcester, Massachusetts.

DRUMLINOIDS OF THE CATATONK FOLIO.*

BY

GEO. D. HUBBARD.

The area designated the Catatonk Folio includes the Dryden, Harford, Owego, and Apalachin sheets of the United States Topographic Atlas, and is situated in the south central part of the State of New York. Ithaca lies near the northwest corner, Owego near the southwest corner, and Binghamton two or three miles beyond the eastern boundary. The Pennsylvania line is coincident with the southern limits.

The region is a part of the maturely-dissected upland of the northern portion of the Allegheny Plateau, and has a relief of 1,500–1,600 feet. The continental glacier once covered the entire area, and extended 50 miles or more beyond;† and in retreating did not leave appreciable moraines in the southern part of the area, but heaped large accumulations in the northern part. Most of the glacial striæ indicate a movement from E. N. E. or N. E.

While there is a great variety of morainic form and distribution in the northern half of the area, and much of interest has been found there, in the southern portion the glacial field is quite monotonous. By far the most attractive till deposits here are numerous rounded hills, usually drumlin-shaped, and distributed rather unsystematically. They vary in length from less than one-eighth to fully three-fourths of a mile, and in height from 15 to 100 feet. Because of their resemblance to drumlins they will be termed drumlinoids.

Descriptions.—In the Harford sheet, which was mapped by Mr. B. S. Butler, the village of Nanticoke is on one of these rounded or elliptical hills, ten of which occur in the one valley. Numerous village wells reach a depth of from 30 to 80 feet, and not one encounters bed-rock. Yet the deeper wells extend below the bottom of the hill. A short distance south of Nanticoke are three similar hills, and about the same distance north are four more; while 2¼ miles N. W. is another pierced by a well 18 feet deep through till. Just beyond the latter is a still larger one, with one well 18 feet deep and another 80 feet deep. Neither well touches rock, but each is reported as having passed through hardpan most of the way. The 80-foot well goes below the base of the hill. All the above ten till-masses stand out abruptly into the valley, forcing the stream to one side and sometimes requiring it to cut in rock.

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* By permission of the Director of the United States Geological Survey. The field work of this paper was done while the author was acting as an assistant to Professor R. S. Tarr under the U. S. G. S. in the study of the physiography and quaternary geology of the Catatonk Folio. Some of the drift forms herein described were mapped and studied by Professor Tarr, and others by Mr. B. S. Butler. Acknowledgment to both is gladly made for contributions received from their work and for many suggestions made during the development of the interpretation of the phenomena. In addition, Professor Tarr has read the report and given valuable criticism and suggestion.

† Lewis, H. C.—Second Geol. Surv. Pa. Z. Ch. 2 and 3.
Wright, G. F.—The Ice Age of N. Amer. Ch. VII.

Another characteristic mass occurs on the Apalachin sheet about a half mile north of Gaskill. (See Fig. 1.) The valley in which it lies is a broad, mature form with a well-developed flood-plain for some distance both above and below this point. The till lies athwart the valley very much like a great dam, higher in the central part than at either side, in outline nearly circular, and about 600 yards across. Its total height above the bordering stream-bed is about 100 feet. So completely does this mass of material obstruct the valley that the stream now flows in a rock gorge 25–75 feet wide along its eastern margin. The rock wall on the east rises precipitously almost 75 feet; but on the west it only shows at one point, where it rises about 10 feet, above which is a till slope of 20–30 feet. (See section, Fig. 2.) The hill is smooth and rounded. An old dug well whose depth is not exactly known, but is in the vicinity of 25 feet, is found near the north side. Between the till hill and the rock wall on the west side of the valley is a low col some 30 feet below the hill top. There must have been a similar but lower one on the east side. Apparently there was a time when this dam across the valley ponded back the waters until they overflowed at

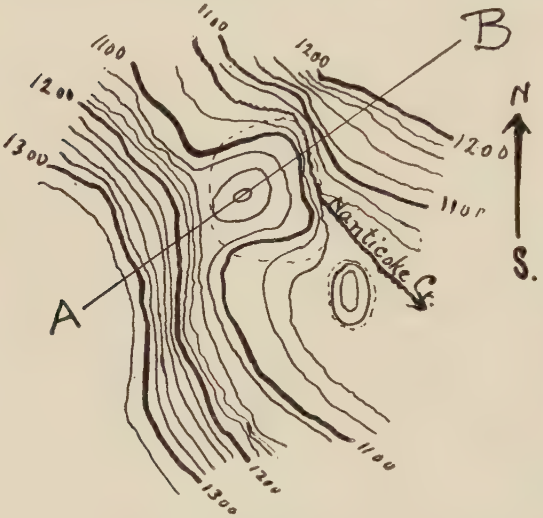

FIG. 1.—CONTOUR MAP OF DRUMLINOIDS, NANTICOKE CREEK, ½–¾ MILE NORTH OF GASKILL. SCALE, 2 IN.=1 MILE. ENLARGED FROM APALACHIN SHEET.

the lowest place, that probably being above the present rock gorge. The lowlands to the north consist of fine sand and clay at the surface.

A quarter of a mile upstream from this large rounded hill is another similar form more separated from the valley wall than the last but not discerned by the topographer. This one is twice as long as broad, rises 60 feet above the stream, and lies with its long axis essentially parallel with the valley at that point, and on its northern slope presents a morainic surface. South of the large mass, above described, the valley contains two more small similar hills, one of which appears in Fig. 1.

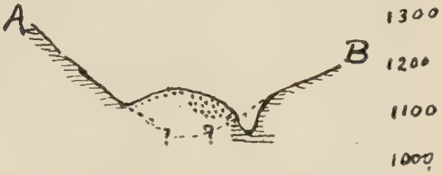

FIG. 2.—CROSS SECTION AT A—B, FIG. 1, VERTICAL EXAGGERATION 8½. DOTS=TILL. LINES=ROCK.

In the valley of Barnes Creek, one and one-half miles northeast of Owego, occurs a small ovoid hill, which forces the stream against rock on the east. Its long axis, 250–300 yards in length, lies north and south and parallel with the valley. A definite sag may be seen between the hill and the west valley wall; and the surface of the former is a little irregular and has one little swamp. There is a good flood-plain below this obstruction, and also for a mile and a half above; but the stream passes the hill in a narrow gorge, in which the Owego Water Board has caused to be erected a dam to retain water for a city supply.

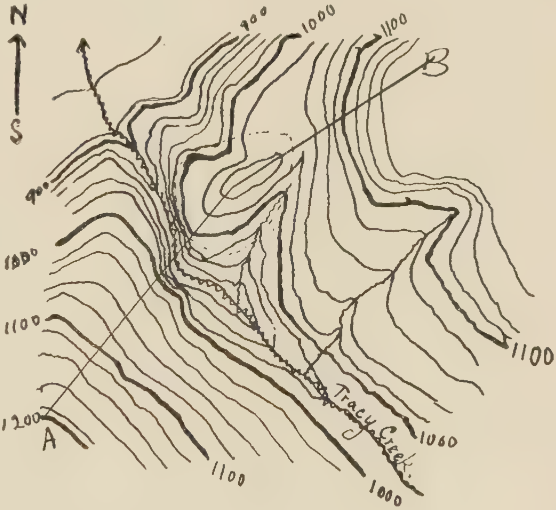

FIG. 3.—NEAR THE MOUTH OF TRACY CREEK A CROSS RIDGE NEARLY CLOSES THE VALLEY. SCALE, 2 IN.=1 MILE.

Near the mouth of Tracy Creek on the Apalachin sheet a ridge, which seems to be essentially all till, lies exactly across the valley. (See Fig 3.) Its surface is smooth and rounded, and not the least morainic. The creek flows through a broad flood-plain for five or six miles above this point, and then, as it runs along the west side of the obstruction, is forced into a narrow rock gorge. The gorge has a high steep bluff of rocks on the west, but only a low one on the east, composed of till, in which the rock shows at but one point. (See section, Fig. 4.)

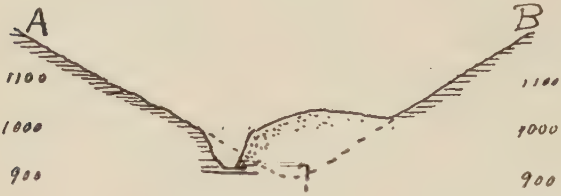

FIG. 4.—CROSS SECTION AT A—B, FIG. 3. DOTS = TILL. LINES = ROCK. VERTICAL EXAGGERATION, 8½.

In the next valley to the west, that of the Apalachin Creek, about half a mile north of South Apalachin, may be found a neat little rounded hill rising in the midst of the valley and tied to the west valley wall by heavy till deposits, which present in part a smooth surface and in part a morainic one. A stream cut on the east exposes only till. The whole structure at this point resembles much a morainic loop, save that its northern and eastern portions are very smooth.

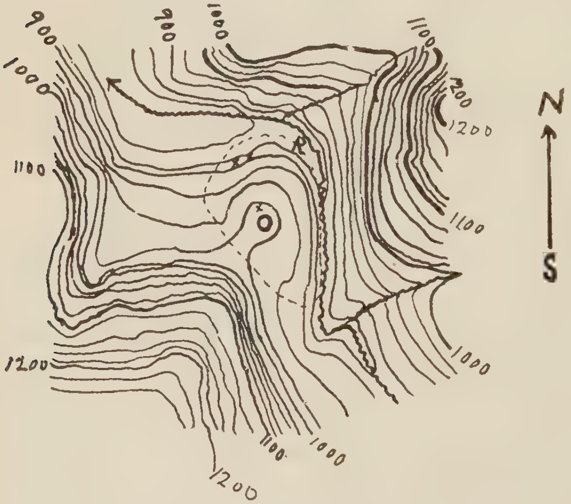

FIG. 5.—DRUMLINOID TWO MILES UP-STREAM FROM VESTAL IN CHOCONUT VALLEY. SCALE, 2 IN. = 1 MILE.

In the valley of the Choconut, where these peculiar forms first attracted marked attention, there are nine individual examples, and clustered to the east of the mouth are four more of doubtful character. All are rounded and some bear striking resemblances to the drumlins of the Syracuse-Rochester, N. Y., district.* Where one axis is appreciably longer than another it lies parallel with the valley, except in one case. Of the four at the mouth of the valley, the two outer ones are parallel with the Choconut, while the two inner ones are parallel to the receiving Susquehanna. Not all of these thirteen hills have been proved to be of till. Several are apparently of till, others may be. Three will be described in detail. The first one encountered after entering the valley lies about two miles from Vestal, a station on the Delaware, Lackawanna and Western Railroad. It is about a half mile in length and nearly a fourth in width, and rises a hundred feet above the stream. Its north end is the broadest, but the middle portion is the highest. The surface is of a weak sag-and-swell type, with no swamps; while between it and the west valley wall there is a well-marked depression. (See Fig. 5.) Two wells on its northern slope are 18 and 23 feet in depth respectively, and neither encounters rock. One on its summit is open and 45 feet deep; no record of material passed through could be found, but a large dug well would scarcely be made in rock. The hill is so situated in the valley that the stream flowing in a broad flood-plain both above and below this point is here crowded into a narrow channel for a third of a mile, but no rock appears at any point in the cut. The whole section is a typical till cut. The stream cuts against rock in the east valley wall just north of the gorge at R in Fig. 5.

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* Lincoln—Amer. Jour. Sci., Vol. XLIV (1892), pp. 290–301.
Tarr—The Phys. Geog. of N. Y. State, pp. 146–151.

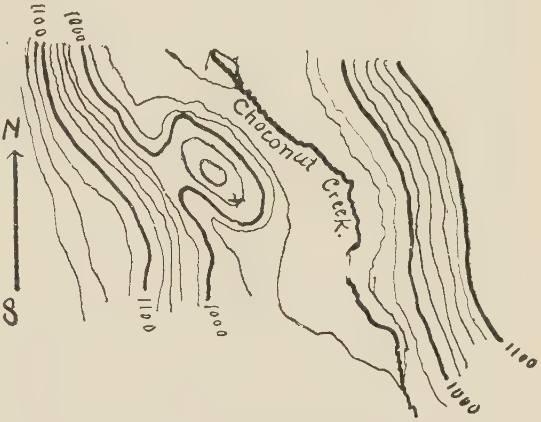

FIG. 6.—DRUMLINOID 3¼–4 MILES ABOVE VESTAL IN CHOCONUT CREEK VALLEY. SCALE, 2 IN. = 1 MILE.

Another smoother, rounder hill occurs a mile farther up stream fairly well separated from the west valley wall but not close enough to the other to crowd the stream; hence there are no stream cuts in it. However, appearance and tradition, the only evidence available, agree that it is not a rock hill. Close to it and to the north is a small rounded hill with its largest and highest end to the south.

A mile above the last large one is the most regular hill found. (See Fig. 6.) Its relation to the valley is all told by the figure. A well dug at X in Fig. 6 is said by the owner to be 25–30 feet deep, but no rock was encountered. If this hill were in a drumlin region it would unquestionably be called a drumlin.

Near the head of a stream entering the Nanticoke at Union Center from the west are two of the smallest examples found. They are 600–800 feet long and about 500 feet wide. Both present good till cuts where attacked by the stream. In another west branch of Nanticoke Creek, some three miles north or northeast of the village of Maine, is a hill with a four-crested summit. The hill is about 1,200 feet by 700 feet, and 50 feet high, well separated from the valley wall and certainly mainly composed of till. There are a number of forms of questionable character in this vicinity.

Still others in Apalachin and adjacent sheets show similar features. Pipe Creek on the Owego sheet, mapped by Professor Tarr, has many. The largest is 60 feet high and three-fourths of a mile in length and stands out into the valley, deflecting the stream. This one is higher and steeper on the north end. There are several stream cuts in it, one 20 feet high, but none reveal rocks. Superimposed on the south end of this larger one is a smaller hill which stream dissection has cut almost in half, exposing only till. Northwest of Straits Corners is the only hill in this valley bearing morainic topography.

At the northeast corner of the Folio but just off into the Cortland quadrangle is a small example of drumlinoid composed chiefly of stratified gravel and sand. So well stratified is the deposit that it has been opened and the sand and gravel drawn away for local use. This is the only drumlinoid reported in the entire Catatonk Folio region with more than traces of stratification.

In the southern half of the Folio the valleys are deeply filled with till and stream deposits, often partly stratified. As a rule this filling lies smoothly in the valley with a narrow trench, of post-glacial development, cut through it; but sometimes bunches of till with little sags behind them cling to the valley sides. Many examples of this class have been half or more cut away by the stream, revealing thick till accumulations. Some of these occur in valleys where the more perfect drumlinoid hills are. By search throughout the whole Folio area examples may be found constituting a series, which passes by small gradations, from the thickened hump of till half removed and easily denominated valley filling, to the well-formed and perfectly preserved drumlin-shaped hill shown in Fig. 6.

There are numbers of forms whose true nature has not been proved. Some of these may be rock, but where they stand out well into the valley, I cannot see how a rock hill could be preserved except in rare accidents or very special conditions. But one example of an authentic rock hill lying in a valley is known in the entire area, and that is a large one near Union in the Susquehanna valley. This hill is several times as large as any of those above described, and its slopes are as steep as, or steeper than, the valley walls in this vicinity, while almost without exception the till hills have much gentler slopes, and hence appear more mature than the proximal valley walls. (See sections and maps.)

Summing up the data presented in the above descriptions the following facts may be stated:

1. About seventy-five, more or less, rounded hills occur in the valleys of the Catatonk Folio.

2. Many of these have been proved by stream cuts and well sections to be composed of unstratified till. Only one is known to be essentially water laid.

3. Some of these hills blend with the valley wall with no definite sag between, some have a well-marked col, and some lie out in the valley free on both sides.

4. Many are so situated as to cause the valley to narrow and widen, and the stream to flow alternately over a broad flood-plain and in a narrow gorge, frequently in the latter case to be obliged to cut a rock channel past the obstruction.

5. The drift hills vary in length from 200 to 1,300 yards; in width from 200 to 900 yards, and in height from 20 to 100 feet.

6. They are usually somewhat elongated, but vary from circular in outline to an axial ratio of 2:1. Where elongated the long axis is usually parallel with the valley in which they lie; in a few cases it extends crosswise of the valley.

7. Rarely are they found in any but approximately north and south valleys, and they seem to lie predominantly in valleys trending a little N.W.-S.E., or approaching a right angle to the direction of ice movement; a few doubtful ones, however, are in the Susquehanna valley; they are known in valleys of all sizes, but are best developed in those of moderate size.

8. Usually the surfaces are smooth and rounded, but in a few instances more or less of the surface is morainic in character. This last seems to occur more frequently on the south end, or on the flank lying nearest to the valley wall.

9. Many half and other fractional forms occur, which fact suggests that the streams have in part destroyed them, and many fractional forms blend more or less smoothly with the ordinary valley filling, suggesting that it is the partly-formed variety which is most easily removed. This is probably due to the lack of ready-

made channel-ways around them when the streams first begin to flow through the ice-evacuated valley.

10. They are grouped in valleys. Rarely is one found alone, but frequently 3 to 8 or 9 in a single valley. They are not reported from the upland, and probably do not occur there, although the difficulty of identifying them and distinguishing them from purely erosion rock forms where stream cuts are rare may have caused an occasional one to be overlooked.

11. A few of the described forms show terminal differentiation, being a little larger or a little higher at the north end; a smaller number show a similar enlargement at the opposite end, but most of them have a maximum height in their central portions.

Theories and explanations. Four hypotheses have been considered in the attempt to explain these interesting features:

First, that they are rock forms and due probably to preglacial erosion; second, that they are morainic loops modified in many cases by stream action; third, that they are over-ridden moraine; and fourth, that they are valley-filling or morainic masses carved or built by ice into drumlin-like forms.

In the early stages of the study the first hypothesis was frequently resorted to, thinking that the hill in question each time was a smaller but similar example of the rock type seen at Union; but it soon became apparent that there was another type. Stream cuts presented the first evidence, and then the well records were sought until it became very evident that many of the forms were of till. Rarely was any evidence found that a suspected hill was of rock. That others whose internal structure is unknown are of the same character, namely, of till, is believed to be true, for two reasons: (*a*) The fact that they lie out in the valleys, thereby narrowing down to a gorge an otherwise broad, mature valley; (*b*) That their slopes, except those recently undercut, are very much more mature than those of the valley walls. It seems probable that if these hills were rock remnants they would possess as steep slopes as the valleys, and possibly often steeper slopes, because in such close proximity to the stream. This should be expected even though they have not been postglacially attacked by the streams.

When it was discovered that the rounded hills were largely composed of till the second hypothesis was proposed, and in support thereof a number of points may be adduced. Sometimes the hills lie almost across a valley save for a narrow postglacial gorge; they predominate in north-south valleys; in two places small loops were found crossing valleys in the southern part of the Folio, and such loops had become very familiar in the northern part and in the adjoining Watkins Glen Folio.* But if this be their explanation a halt of the ice-front sufficiently long to build such moraines ought to have been sufficient to construct some sort of a moraine on the valley side and to lay down washed gravel in the valleys beyond the loop. Repeated diligent search failed to reveal either moraine or gravel. No possible morainic connection has been found in any case leading away from the drumlinoids along the valley sides. In fact, in the whole southern portion of the Folio where the types are best developed no systematic moraine was found. Further, except in rare cases there has not been found characteristic morainic topography in any of the drumlin-like hills.

As the third hypothesis was developed the suggestion came that the peculiar feature might stand for over-ridden moraine—*i. e.*, moraine made by halts during the advance of the ice or, perhaps, during an earlier advance. There is, however, at present no recognized evidence in this vicinity of an earlier advance.† The facts that the hills in question are composed of till, that they are in the north and south valleys, and that they are generally smoothed forms, lend colour to the suggestion; but it seems probable, as in the consideration of the previous hypothesis, that, if it be moraine, with so great accumulations in the valleys there should be moraine on the valley slopes as well. Provisionally it may be answered that the hill moraine would certainly be weaker than that of the valley, and therefore may have been more completely wiped away by the ice. However, not only is there no moraine on the valley sides but there is no trace even of over-ridden moraines. It may be possible that hill moraine could be completely brushed away by an ice invasion, and hence that this explanation may account for the presence of the drumlin-like masses in the valleys as unremoved remnants of moraine; but it seems much more probable that the forms in the valley, above which the ice was thicker and heavier, would be wiped off before those in the upland, beneath less of a burden. Further, moraine deposits are very complex, while this material is almost universally very simple and homogeneous in structure. Hence, the author was led to the conclusion that the theory of over-ridden moraine was scarcely adequate to account for all the phenomena.

There is, in practically all the valleys of the Folio, a large quantity of till which has apparently been brushed in by the ice.

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* Bull. Geol. Soc. Amer., Vol. 16 (1905), No. 10, pp. 215–228, and U. S. G. S. Watkins Glen Folio (in press).

† *Ibid*, p. 217.

This material throughout the whole study has attracted much attention and has been the source of constant study. It is till, often containing large angular boulders of the country rock as well as foreign material, and is usually smoothed into the valley to considerable depths. In many valleys this drift is somewhat bunchy. Sometimes it is deeply trenched by the main stream and even by valley side-rills. It sometimes presents rounded forms into which the streams have cut deeply, and, as stated on a previous page, there are all gradations in form and size—from the little, insignificant bunches of valley filling half or more eroded to the large, complete drumlin-like hill. This suggested a fourth hypothesis—namely, that the peculiar forms are a consequence of ice building or carving in this thickened deposit of till. As points in its favour are brought forward: (*a*) The relation of so many of the forms, distinctly drumlinoid, to the typical valley filling; (*b*) the gradational series from ordinary bunched filling to the typical drumlinoids; (*c*) the absence of morainic connection on the valley walls with the drumlinoids (of course, if the valley hills are carved from the valley filling no upland moraine need have existed); (*d*) the absence of examples in the uplands, cirques, and higher valleys, where, if formed from moraine, certainly some forms should be. This hypothesis may not apply to all forms described above, as, for example, that shown in Fig. 3, but it may well explain such forms as that of Fig. 6. The wholly unstratified and homogeneous structure of all drumlinoids, save one, whose interior arrangements have been seen, argues very strongly against the second alternative in this hypothesis. The presence of some stratification in the Rochester-Syracuse drumlins may point to a constructive process for their origin, but the absence of bedding and the homogeneity of texture lead strongly to the belief that these drumlinoids were carved out of pre-existing deposits rather than that they were built up by successive additions.

The striking resemblance of some of the better specimens of drumlinoids of the Catatonk Folio to the drumlins of the Rochester-Syracuse, northern Michigan,* or Wisconsin† drumlin areas, suggests a community of origin, and yet the distribution is extremely different. Drumlins have usually been found in extensive groups and in regions of otherwise weak relief. Here we have them scattered widely, two or three to eight or ten in a valley, with long stretches of country between them and in a region deeply and maturely dissected. It is because the forms present so many similarities to drumlins and yet differ from them in these several respects that the name drumlinoid has been given them.

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* Russell, I. C.—Amer. Geol., Vol. XXXV. (1905), No. 3, pp. 177–9.

† Chamberlin, T. C.—Geol. Surv. Wis. Vol. I., p. 283; Jour. Geol., Vol. I. (1893), pp. 255–267. Upham, W.—Amer. Geol., Vol. XIV (1894), pp. 69–83.

They may represent a new phase of the drumlin and emphasize further the belief that we are at present including under the term drumlin several distinct forms with perhaps as many origins. Since our drumlinoids are apparently due to ice erosion in soft till, mainly valley filling, this study may be a contribution to the general problem of the origin of some of the drumlins of the more classic areas.

NOTE.—I have noticed in some of the Swiss topographic maps the description of forms in the Swiss valleys similar to these drumlinoids which offer an inviting field for study, and possibly present material which when studied will yield a valuable contribution to the present problem.

OHIO STATE UNIVERSITY.

THE LEARDO MAP OF 1452.

Giovanni Leardo was a Venetian cosmographer, who lived in the fifteenth century and remained unknown, except by name and tradition, for four hundred years.

In 1850 Signor Vincenzo Lazari discovered in the Museum of Vicenza a planisphere, or map of the world, which bore the signature: *Johanes Leardus de Venetiis me fecit ab anno domini 1448.* Lazari sent a description and a drawing of the map to Santarem, who published the description, with critical remarks, in his *Essai sur l'Histoire de la Cosmographie, etc.* (Tome 3, pp. 398-442), and printed a facsimile of the drawing in his Atlas.

In 1879 Friedrich von Pilat, Consul-General for Austria-Hungary in Venice, purchased from a private collection in that city a map of the world on parchment, with the inscription:

Johanes Leardus de venetteis me fecit abano domini 1452.

A description of this map was read before the R. Instituto Veneto di Scienze, Lettere ed Arti in 1880 by Dr. Guglielmo Berchet*, and printed in pamphlet form the same year by Ferdinando Ongania, of Venice, to accompany the photographic reproduction of the map in the Collection of Italian Charts and Maps of the Middle Ages published by him. The parchment on which the map is drawn is 60 centimeters wide (23⅝ in.)

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* The facts here given are taken from Dr. Berchet's paper.

and 73 centimeters from top to bottom (28¾ in.). At the top is the chevron of the Trevisan family.

At the bottom of the parchment a strip, 3½ in. high, contains the legend, with the signature of the author and the date.

Above this strip is a parallelogram, enclosing ten concentric circles drawn around the map, which occupies the centre.

The inscriptions are not easily read, the writing having faded in many places and the parchment having suffered in others.

The legend begins with a reference to the Creator and the Passion, and then gives the diameter of the earth, "according to the excellent astrologer and geometrician Macrobius," as 6,857 miles, which happens to be not far from the actual measurement of 6,876 nautical miles.

Leardo then gives the diameter of the Moon, of Mercury, Venus, Mars, the Sun, and Saturn, as well as that of the universe and the crystal sphere; all wholly fanciful.

The innermost of the ten circles shows Easter Day for 95 years, beginning with 1452.

The second circle marks the months of the year, with the signs of the zodiac.

The third circle gives the phases of the moon, according to the cycle of 19 years, distinguished by 19 letters of the alphabet.

The fourth circle is that of the days of the months.

The fifth circle is that of the hours.

The sixth circle is that of the *points* of the hours; each hour being divided into 1080 points, or instants.

The seventh circle gives the dominical letter.

The eighth circle gives the length of the days throughout the year, and in the ninth the variation from day to day is marked.

The tenth circle contains the name of the titular saint for each day of the year.

The map drawn within these circles is 15¾ inches in diameter. The east is at the top of the map and the south at the right hand of the observer.

Jerusalem is in the centre. The earth, which is quite symmetrical, is surrounded by the sea. The Gulf of Guinea on the west and a similar gulf in the east under the same parallel through Africa form pendants to two smaller gulfs in the north, the Baltic and the Sea of Okhotsk.

The names of the continents are written in red on a white ground and the islands are in red and yellow, with the exception of Ireland and England, which are green.

Europe contains 47 cities, Asia 75, Africa 74 and Ceylon (Taprobane) 4, all coloured green and red. Mountains are barely indicated; the seas are blue, except the Red Sea, which is deep red; the lakes are blue, yellow, and rose, and the rivers green and blue.

Latitude and longitude are not marked. The Mediterranean is made too long and the western coast of Europe is badly drawn, but Scotland and England form one island. The Scandinavian peninsula has a western inclination and the northern parts of Europe and Asia are depicted as *the desert uninhabited on account of cold.*

In Asia, Corea, China and India are incorrectly shown and without Japan and Formosa. On the far eastern coast a castle with two towers marks the site of the Terrestrial Paradise.

In southern Asia the Indian peninsula is less incorrect than in the Bianco map, and a noteworthy progress in knowledge is the disappearance of the great gulf between India and an eastern prolongation of Africa, still found in Bianco. With this gulf disappear also the traditionary twelve thousand islands of Marco Polo.

The southern part of Africa is a work of pure fancy, painted a fiery red beyond a band which divides the inhabited part from the *desert uninhabitable because of heat.*

The Gulf of Guinea is made mediterranean, and on the Atlantic coast of Africa the Canary Islands are shown, with the first Portuguese discoveries.

The Black Sea is fairly well drawn, though it is in the latitude of England; the Caspian has much the same shape as the Black Sea, but it is correctly shown as a closed sea and without the supposed communication with the Icy Ocean. The Red Sea, as in all the older maps, makes an angle towards the east, but it is made to begin east of Jerusalem, almost at the point of commencement of the Persian Gulf, and it reaches to Cape Guardafui. No account is taken of the strait of Bab-el-Mandeb.

There are two Niles. One flows from Ptolemy's Mountains of the Moon; the other branches from the first, forms various lakes and finds its way to the Atlantic.

The rivers are badly drawn, but less so than by Bianco and preceding cosmographers.

Leardo, like others of his time, finds place in his map for the legends current in the Middle Ages. Almost under his Terrestrial Paradise are three inscriptions: *Here they eat human flesh;* and to the left: *Desert where there are many griffins;* and on the right: *The Thirty Days' Desert* (possibly the Desert of Gobi). Farther north, near the line of the frozen region, is a turreted temple, with the legend: *This is the sepulchre of the Great Khan, and they do this: when he is borne to his burial, he comes accompanied by many armed men, who kill those whom they meet on the road, and they say that the souls of these persons are blessed because they go with the soul of the Great Khan to another life.*

North of Scandinavia Leardo puts *the people who do not see the sun for four months in the year;* and south of Ethiopia we find the empire of Prester John and these two inscriptions: *Here are four-footed animals with human faces;* and *Here are men with faces in their breasts.*

This most interesting map was acquired in April of this year by a member of the Council and presented to the American Geographical Society.

GEOGRAPHICAL RECORD.

AFRICA.

RUWENZORI PEAK REACHED.—Almost simultaneously with the arrival in Mombasa of the Duke of the Abruzzi and his party on their way to attempt the ascent of the Ruwenzori range, the *Geographical Journal* of the Royal Geographical Society (May, 1906) announces that Mr. Rudolf Grauer, an Austrian, with the Messrs. H. W. Tegart and H. E. Maddox, members of the Church Missionary Society in Uganda, have reached one of the peaks of the Range. On Jan. 18, their camp was just below the Mubuku glacier; and as they had to return to camp every night, three days elapsed before they were able to reach the peak, which they named King Edward's Rock, the top of which is about 15,070 feet above sea-level. They were much delayed throughout their work by fogs. In their opinion, the highest peak of the range is the one to which Sir Harry Johnston gave the name Duwoni. It is not far from King Edward's Rock, and they believe it is not over 16,500 feet high. They say that this culminating point of the range can be ascended if the porterage difficulty is overcome, so that provisions may be brought up and camp established at the base of the peak, where the climbers may wait for favourable conditions of weather.

COLLECTING EXPEDITION TO BRITISH EAST AFRICA.—The *Journal* of the American Museum of Natural History (April, 1906) says that Mr. Richard Tjader, a traveller and hunter of wide experience, accompanied by Mr. Herbert Lang, one of the Museum preparators, left New York on March 1 on an expedition into British East Africa (Uganda) for birds and mammals, particularly the large mammals of the region, for the Museum collections. The party will land at Mombasa on the east coast and proceed thence by railroad to Nairobi. From Nairobi advance will be made by a circuitous route northward, westward, and southward to Port Florence on Lake Victoria, whence return to the coast will be made by boat and rail. The expedition has been provided for through the generosity of Mr. Samuel Thorne.

NAIROBI ON THE UGANDA RAILROAD.—Major Wangermée, Vice-Governor of the Congo Free State, describing his recent journey over the Uganda railroad, in the *Mouvement Géographique* (No. 16, 1906), says that Nairobi, the most important town on the line west of Mombasa and about half way between the Indian Ocean and Victoria Nyanza, stands at an elevation of 5,450 feet, the altitude assuring a comparatively temperate climate, which permits the cultivation of many varieties of European fruits, cereals, and vegetables. The European population is therefore increasing, and the white colonists, who have brought their families to Africa, have no desire to return to the mother country. As the train stops at the station, a considerable number of carriages and wagons are seen waiting for passengers or baggage. These conveyances are drawn by one, two, and even four horses. A number of English women come down to the station to await the distribution of the European mail. The town is planned on a large scale, and has a European quarter, where over 500 whites are living, and other distinct quarters for the Hindus and the negroes. Most of the houses and all of the railroad buildings are of galvanized iron, and even the chicken and dog houses are of the same material. An agricultural society is studying the best methods of cultivation and the kinds of useful plants and animals that will thrive best in that region, and is spreading this information among the colonists.

THE KHEDIVE VISITS THE OASIS OF SIVA.—The Khedive has just made an interesting journey to Siva, on the border between Tripoli and Egypt. He left Alexandria on Feb. 11 with four European companions and an Egyptian secretary, and reached the oasis nine days later. After having covered most of the way through the desert, about 325 kilometers, in seven days, camp was pitched five kilometers from the oasis, which was entered two days later. Five days were spent in visiting the fertile fields and gardens and talking with farmers and merchants as to the needs of the region and the best means of developing its resources. The oasis grows a large number of date-palms and olives, besides many fruit trees, some of which, like the apple, are scarce in Egypt. There are numerous brooks, but they are poorly utilized, and their waters are permitted to form unhealthful swamps. The Khedive returned to Alexandria on March 6.

EXPLORING EXPEDITION TO LIBERIA.—Dr. Walter Volz, Lecturer in Zoology in the University of Bern, will head an exploring party that is to be sent into the practically unknown hinterland of Liberia. This Great Forest region, which has been penetrated far east only by one or two explorers, will this time be approached from Sierra Leone. The funds have been supplied by the geographical societies of Switzerland, and the purposes in view are as much commercial and industrial as ethnographical and geographical. The scientific collections are to become the property of various Swiss museums.

SCIENTIFIC RESEARCH IN THE GERMAN AFRICAN COLONIES.—The *Zeitschrift* of the Berlin Geographical Society (No. 7, 1905) says that it is intended to place the investigation of the geography of the German African colonies upon a systematic basis. A year ago a committee was appointed to inquire if more scientific results might not be obtained by the concentration of effort in one organization, instead of spreading the work of investigators among several channels, as has heretofore been the practice. The Committee has recommended that the detailed study of geography hereafter be carried out by stationing scientific observers at the Government posts by attaching them to expeditions and similar methods. The scope of their researches is defined as embracing "all departments of scientific knowledge that relate to the earth's surface and to its vegetable, animal, and human inhabitants."

DISTRIBUTION OF THE NEWTOWN PIPPIN.—The *Agricultural Journal* of the Cape of Good Hope (April, 1906) says that the Newtown pippin is recommended as a good variety to plant in South Africa, as it has been proved to thrive there. California is shipping Newtown pippins gathered in October and November to London, where they arrive in splendid condition, and may be kept in cold storage until the following March. The *Journal* says that this apple may be grown in South Africa in large quantities and shipped to England at a good profit.

About 200 years ago a seed from a roadside apple tree in the township of Newtown (Long Island), now a part of the City of New York, dropped into the edge of a swamp, and the tree that sprang from it was the original Newtown pippin. Grafts from this tree and its descendants have spread the fruit through parts of New York State, the middle Atlantic States, and along our Pacific coast, but the fruit does not yield its best results in the New England States. It has always been very popular in European markets as one of the best imported apples. The news that this famous apple is thriving in South Africa is an interesting illustration of the wide distribution of a commodity.

AMERICA.

TELEGRAPH LINES IN ALASKA.—It is announced from Washington that many changes in the telegraph lines in Alaska are in contemplation by the Signal Corps. The lines extending inland from Valdes to Eagle City and then down the Yukon to St. Michaels are very crooked, as it was thought best, owing to the roughness of the country, to stretch the pioneer wires along the streams. It is now the purpose to straighten these lines and shorten them wherever possible. The duplex system is to be introduced on the Alaskan cables, increasing their capacity about 75 per cent.—an important improvement, as the operators have difficulty now in handling all the business offered.

NEW BUILDING FOR THE GEOLOGICAL SURVEY.—A bill was introduced in both houses of Congress in March to appropriate the money required to erect a new building for the U. S. Geological Survey. The working force numbers nearly 2,000 persons, of whom half are employed only in summer. About 600 are engaged during the winter months in office work at Washington. The two buildings rented in that city for accommodation are so inadequate that even the corridors have to be utilized for desk space and map cases. Some employees are permitted to work at home for lack of proper office facilities, and others are housed in the National Museum and Smithsonian Institution. *Science* says (No. 594) that "Chemists, physicists, photographers, petrographers, draftsmen, engravers, lithographers, and other specialists must have room for their instruments, working specimens, drawings, lithographic stones, presses, etc." The degree of crowding to which the office force is now subjected diminishes the quantity and depreciates the quality of the work.

The rented buildings, moreover, are not at all suitable for some purposes of the Bureau. About twenty-five rooms in the main building are so dark that work can be done only with the aid of artificial light. Forty-five persons are working all day in the largest of these rooms with the help of electric light. The delicate physical apparatus is constantly affected by the vibrations of the heavy printing-presses. The buildings are not of modern fire-proof construction, and Government property and records, estimated to be worth $6,000,000, are in constant danger of loss by fire. The Survey needs a strong, fire-proof, well-lighted building containing a net available space of at least 150,000 square feet, exclusive of basement and halls. Such a building would cost about $1,200,000, and the annual rent now paid on the buildings occupied is nearly three per cent. on that amount.

U. S. WATERS THAT REACH HUDSON BAY.—All the waters that reach Hudson Bay from the United States pass through Lake Winnipeg and thence into the bay through Nelson River. The two principal tributaries of Lake Winnipeg, and thus, indirectly, of Nelson River, are the Saskatchewan and the Red River. The Saskatchewan drains the major portions of the provinces of Alberta and Saskatchewan and the northwestern part of Assiniboia, in the Dominion of Canada, and, through St. Mary River, a small area in northwestern Montana in the United States. The Red River drains a large basin in the United States, covering portions of Minnesota and North and South Dakota. Both rivers are large and important.—(*Water Supply and Irrigation Paper,* No. 171.)

HYDROGRAPHIC WORK OF THE U. S. GEOLOGICAL SURVEY.—This work includes the collection of facts concerning the behaviour of water from the time it reaches the earth as rain or snow until it joins the oceans or great navigable rivers. These investigations became a distinct feature of the work of the Survey in the fall of 1888. The first specific appropriation for gauging streams was $12,500 in 1894. The appropriations have been gradually increased until, for the past four years, they have been $200,000 annually. The chief features of the work are the collection of data relating to the flow of surface waters and the study of the conditions affecting this flow. Studies are also made concerning river profiles, duration and magnitude of floods, water-power, etc. This work includes the study of the hydrography of every important river basin in the United States, and is of direct value in the commercial and agricultural development of the country. About 800 regular gauging stations were maintained in 1905, and the results of the work are published in a series of fourteen "Water Supply and Irrigation Papers" (Nos. 165 to 178).

DR. GILBERT AND THE SAN FRANCISCO EARTHQUAKE.—Dr. Gilbert, of the U. S. Geological Survey, was in the neighbourhood of San Francisco at the time of the recent earthquake. Instructions were at once sent to him from Washington to make as thorough a study as possible of the earthquake phenomena. He has been engaged for some time in making hydraulic experiments in the mining laboratory of the University of California at Berkeley.

PROGRESS OF THE RECLAMATION WORKS.—Mr. F. H. Newell, Chief Engineer of the U. S. Reclamation Service, has returned from an inspection of the works now under construction in Oklahoma, New Mexico, Arizona, California, Nevada, Utah, Colorado, and Kansas. The expenditures on the water storage and distribution systems are now aggregating about $1,000,000 a month, and in its magnitude the work is now among the first of public undertakings. Most of the large engineering problems have been worked out, and the activity on the more expensive undertaking is now at its height. The present rate of construction and expenditure is at its maximum, and will gradually decrease.

GEOLOGICAL WORK IN IOWA.—The Iowa Geological Survey, during the past year, has been investigating the peat deposits of the State, and has published the results in a preliminary report. A member of the staff has continued investigations of the coal deposits, both stratigraphical, areal, and in the matter of coal tests. This work will be published as a monograph when it is completed. Another phase of the work now in progress is a study of the quarry products of Iowa, including lime, cement materials, etc., with tests of them. This work, also, will be published separately.

KANSAS STATE GEOLOGICAL SURVEY.—The University Geological Survey was organized by the Board of Regents of the University of Kansas in 1894. In 1897 the State Legislature recognized this organization, and has regularly made appropriations for it at each session of the Legislature since that date. It has been provided that the Chancellor of the University should be *ex-officio* Director of the Survey, and the Professor of Geology of the University should have immediate charge of the Survey and should be State Geologist.

Volume VIII, containing the report on lead and zinc, is now being distributed. The appropriation bill for 1905 provided for the publication of a special report on oil and gas and also for an annual report on the mineral resources of the State.

The field work during 1905 was confined principally to investigations in connection with the report on oil and gas. Detailed stratigraphic work on the coal measures of the State was practically completed, and during the past winter maps of them have been prepared. Data were gathered last year and arranged for publication on the production of lead, zinc, coal, oil, gas, Portland and hydraulic cement, gypsum, salt, clay products, building-stone, and sand. Extensive investigations on roadbuilding material are now under way, and tests are being made on Kansas lime and sand for making sand-lime-brick.

CLIMATIC CENTRES AND CENTRES OF PLANT DISTRIBUTION.—In a recent number of the *American Naturalist* (Vol. XXXIX, No. 468, 1905, pp. 875-889), Edgar N. Transeau brings out the results of a study of the centres of plant distribution in relation to climatic conditions. Investigation has shown that forests, grass-lands, and deserts are arranged about certain climatic centres, the term "centre" not implying that the plants have necessarily spread from these regions, but that the most favourable climatic conditions for any special type of vegetation are here localized. In departing from these centres these conditions become more and more unfavourable. The author finds that if the ratios produced by dividing the amount of rainfall by the depth of evaporation for the same station be plotted on a map, they exhibit climatic centres corresponding in a general way with the centres of plant distribution. Moreover, the distribution of grassland, prairie, open forest, and dense forest regions is clearly indicated. This is believed to be explained by the fact that such ratios involve four climatic factors of the greatest importance to plant life—viz., temperature, relative humidity, wind velocity, and rainfall. An interesting map of eastern North America shows the ratio of rainfall to evaporation, expressed in percentages.

The method suggested by Mr. Transeau is a novel one, and the relations which he has worked out are suggestive. Unfortunately, the whole matter of evaporation measurement is in a very uncertain and unsatisfactory state—a fact which the author clearly recognizes—and the relation between actual evaporation and possible evaporation has not been generally appreciated. Nevertheless, the conclusions reached in this paper are certainly interesting and important, and deserve attention. The Great Plains are marked by a rainfall equal to from 20% to 60% of the evaporation called for. The prairie region is indicated by a ratio from 60% to 80%. Here forests are confined to the low grounds. Between 80% and 100% is a region more or less coincident with "open forests," "groves," and "oak openings" on the uplands and dense forests on the low grounds. The deciduous forest centre in the southeast corresponds with the area of from 100% to 110% of ratio between rainfall and evaporation. The distribution of ratio above 110% in the coastal plain is similar to the position of the southeastern conifer centre. R. DeC. W.

Forest Planting in Oklahoma.—*Bulletin* No. 65, Forest Service, by G. L. Clothier, gives *Advice for Forest Planters in Oklahoma and adjacent Regions.* The Forest Service has for several years past been co-operating with farmers in making forest plantations in that district, and the information given in this *Bulletin* was collected by agents of the Service chiefly in connection with the making and execution of these plans. A large part of this region is practically without natural forests, and but a small part can grow trees without cultivation. The rainfall decreases from over 38 inches annually in the southeast to less than 12 inches in the northwest; but the soil is very fertile, and there is no doubt that, by means of a careful selection of species, the choice of suitable situations, and the proper management of the plantations, useful forest trees may be grown in every county of the region. Success in tree-planting on the plains, where rainfall is light and irregular and where evaporation is great, depends very largely upon proper tillage of the soil, careful directions for which are given. On the plains, also, a windbreak of forest trees must be provided on the south and west sides of the planting site, and is advisable, though not essential, on the north. The primary object of the windbreak is to shelter the orchard or a residence site, and to prevent hot winds from scorching the field crops. Valuable material may be furnished by the windbreak, but on the plains of eastern New Mexico and western Texas it must be a permanent feature of the farm, and must be maintained for its protective effects rather than for its product of wood. Several planting plans are described and illustrated; a good map of the region, showing rainfall and the silvical belts; and several half-tone illustrations of the results of planting accompany this Report. R. DeC. W.

Forest Belts and Climate in Kansas and Nebraska.—*Bulletin* No. 66, Forest Service, by Royal S. Kellogg, deals with the *Forest Belts of Western Kansas and Nebraska,* embracing the territory in Kansas and Nebraska west of the ninety-ninth medidian, and in Colorado east of the one hundred and fourth meridian. The climate of nearly all this region is essentially semi-arid, with light rainfall, unevenly distributed, high winds, excessive evaporation, and great fluctuations of temperature. These conditions become more marked from east to west, and are clearly reflected in the character of the forest growth and in the gradual disappearance of tree species. At Hays, Kans., the mean annual rainfall is 20.9 inches. At Wallace, due west of Hays, near the Colorado line, it is 16.1 inches. The average precipitation at Kearney, Neb., is 25.8 inches; at North Platte, 17.7 inches; at Gering, 14.8 inches. These places are on the Platte River, and clearly illustrate the increasing aridity towards the west.

The fluctuations in rainfall from year to year, and the irregular distribution through the year, are of more importance to forest growth than the mean annual amount. During thirty years at Dodge, Kans., the driest year gave 10.1 inches, and the wettest gave 33.7 inches. If the average rainfall at Dodge, 20 inches nearly, were constant and well distributed, it would suffice for the growth of many species of trees, but, as it is, the species actually found there are those which can endure a year with a rainfall of only 10 inches. This is likewise true throughout the plains region. Evaporation on the plains is much increased by the high winds, which cause at least four times the evaporation that would be found in a calm. The spring winds are especially high. The prevailing wind is northwesterly in winter and south to southwest in summer. The rainfall, as just noted, decreases from east to west; but evaporation increases, so that there is a rapid decrease westward in the amount of moisture available for plant life.

It results, naturally, from these conditions that the common hardwood trees are confined chiefly to the water-courses or comparatively wet locations. There is not sufficient subterranean water for all species, and the excessive evaporation limits plant distribution. The evaporation from leaves may be faster than the supply of water obtained through the roots, even when the latter are in very moist soil. In seasons of severe drought trees are killed. Climatic conditions, without question, are the limiting factors in the distribution of the tree species belonging to the valley type. Any factors which check wind movement and decrease evaporation render conditions of tree growth more favourable. Thus, cañon sides facing north, and hence less exposed to summer winds and the intensity of summer heat, are often covered with small trees and shrubs, while the opposite side of the same cañon contains hardly any woody growth. North and northeast slopes throughout this region are more favourable to tree growth of every kind than are other slopes or open levels.

The natural forest growth in Kansas and Nebraska is limited to the river courses and a few upland areas of pine and cedar. The valley type is the common forest type, composed mostly of broad-leaf species, and in the western part of both States confined closely to the water-courses. These broad-leaf species need more water than the conifers, and there is no good growth of them anywhere, except where the roots can reach nearly to permanent water. A good map of the forest distribution in western Kansas and Nebraska accompanies the Report. R. DEC. W.

THE COON BUTTE METEORITE.—A meteoric stone was found by Mr. D. M. Barringer in June, 1905, not far from Coon Butte, Ariz., which is described by Professor Mallet in the *American Journal of Science* for May. The aërolite was lying on the surface of the thin soil which covers the level limestone plain, the greater part of it being exposed to view, as it was imbedded in the soil only about an inch. Two broken corners were exposed to view, and the fractures exhibited seemed to be quite fresh. Mr. Barringer inferred that these corners were broken off at the time of the fall. No fragments were found; and it is believed that the stone struck the earth at some distance from the place where it was found and bounded to this spot. Mr. Barringer thinks it highly probable that this aërolite was seen to fall by two different parties of observers about the middle of January, 1904.

MOUNT MCKINLEY.—Dr. F. A. Cook of Brooklyn will make another effort, this summer, to reach the top of Mount McKinley, the highest American mountain. He will be accompanied by Professor H. C. Parker of Columbia University, who has had much mountaineering experience. They have taken with them a number of assistants. Dr. Cook's first attempt to ascend the mountain was described by him in the BULLETIN (No. 6, 1904).

TIDES ON THE PACIFIC COAST OF CANADA.—A report by Mr. W. Bell Dawson, the engineer in charge of the Canadian Tidal Survey, on "Tide Levels and Datum Planes on the Pacific Coast of Canada" has been published by the Government (Supplement No. 1 to the 38th Ann. Rep. of the Dep. of Marine and Fisheries). It will be remembered that the tidal survey on the Atlantic side has been in progress for some years under Mr. Dawson's direction, and that the results have enabled the Marine Department to issue tide-tables for most of the principal ports. The levels which a continuous record of the tide affords are valuable not only for marine purposes but also for reference in the construction of wharfs, dredging, and other harbour improvements, and in city works.

The survey has now been extended to the Pacific Coast. The report says that the bench-marks and data used by the Admiralty and the Hudson Bay Company, in various towns on the coast, have been connected by levelling, and the bench-marks of Victoria, Esquimalt, Vancouver, and other tidal stations referred to one common standard. These levels are printed in the report.

While in the North Atlantic the tides are found to be chiefly influenced by the moon's phases, those of the Pacific have a pronounced diurnal inequality, which accords with the declination of the moon, and is also subject to an annual variation with the change in the declination of the sun. The solar influence is unusually large in the Pacific relatively to the lunar influence, and the annual variation is thus the more accentuated.

On some parts of the coast, during the greater part of the day, there is a long stand or only a slight fluctuation near high-water level, with a sharp, short drop to low water, which occurs once in the day. Owing to this diurnal inequality the two highest and lowest points in the tide-curve for the month may be as much as five days before or after the full and new moon. While the tides on the Atlantic side of Canada follow the phases of the moon, and accordingly the alternations of spring and neap tides are the dominant features, the tides on the Pacific side may be described as declination tides.

THE FIFTEENTH INTERNATIONAL CONGRESS OF AMERICANISTS, QUEBEC, 1906. The preliminary programme, issued in May, defines the subjects to be considered:

(*a*) The indigenous races of America, their origin, their geographical distribution, their history, their physical and intellectual characteristics, their languages, their civilization, mythology and religion, their manners and customs.

(*b*) The indigenous monuments and the archæology of America.

(*c*) The history of the discovery and the European occupation of the New World.

The languages of the Congress are French, English, German, Spanish and Italian.

Members are requested to forward to the Secrétaire Général, as soon as possible, the *titles* of their papers. The author of each communication registered in the programme must send in, before July 1, 1906, a summary to be printed in the daily Bulletin of the Congress.

Thirty-nine papers are already inscribed.

Details concerning receptions, excursions, etc., will be given in a subsequent programme.

The museums and libraries of Quebec will be free to the members of the Congress.

The membership fee is Three Dollars.

All correspondence is to be addressed to

DR. N. E. DIONNE,
Secrétaire général.

THE GEOLOGICAL SURVEY OF CANADA.—Some changes have recently been made in the organization of this Survey. For more than five years Dr. Robert Bell has been the Acting-Director, and has managed the business of the office as well as its scientific affairs. Mr. A. P. Low has now been appointed Director of the Survey and Dr. Bell has received the title of Chief Geologist of the Dominion. Dr. Bell will continue to prepare his reports, maps, and other work, but will be relieved of the large amount of routine involved in the management of the Survey. Since this began, sixty-three years ago, about 470 maps have been prepared and issued, and nearly one-third of this number has been published during the last five years.

DR. KOCH-GRÜNBERG IN THE UPPER RIO NEGRO REGION.—Dr. Koch-Grünberg recently returned from the region of the upper Rio Negro, a part of the northern Amazon basin that was very little known. Late last year he addressed the Berlin Geographical Society on his journey, and the account of his itineraries and his ethnological researches appears in the *Zeitschrift* of that Society (No. 2, 1906). The map which accompanies his paper is in part original material for the cartographers, as the explorer traced some of the unknown head waters of the Rio Negro. He made his headquarters at São Felippe, far up the Rio Negro, and found this town to be a well-ordered settlement in which a good measure of civilization has been introduced by a Spaniard who had settled there. In his journeys on the Içana, Uaupés, Aiary, Curicuriary, and other streams that swell the volume of the upper Rio Negro he observed, as a characteristic of the region, that the water systems approach quite near to one another. The Aiary, for example, in its upper course, approaches so close to the Uaupés as to permit the journey from one stream to the other to be made in three and a half hours across a low water parting. The Tiquié, a western tributary of the Uaupés, is separated from the system of the Yapurá by a low water-parting that was crossed in fifty minutes.

Dr. Koch-Grünberg made four journeys along these waterways, some of which rise in Colombia and others in Venezuela. On his second journey he descended the Rio Negro to the mouth of the Curicuriary, where he climbed a mountain of the same name which the natives associate with many legends. The path up the mountain led through splendid virgin woods, and the ascent was difficult; but he was amply compensated by the view over the boundless forests. Comparatively few Indians live in this region, and they are emigrants from the Uaupés, chiefly Tukanos, who have here found a refuge from the advance of so-called civilization. He also found wandering Indians, the Maku, who live on a much lower plane of culture. Most of the rivers are broken by waterfalls. He collected much ethnological material among the various tribes, some of whom had never seen a white man. He says that black-and-white water streams alternate without apparent reason, the two kinds occurring sometimes only a few hundred yards apart, though flowing through the same forest and over the same soil. The natives regard the white water streams as conducive to fever, while they assert that the black water streams have no evil influence. The third journey, up the Uaupés, involved great labour, on account of many waterfalls; but above the junction with the Jurupary the river presents a wholly different character, and flows sluggishly through swamp lands entirely uninhabited.

THE FOSSILS FROM PATAGONIA.—Dr. William B. Scott, Professor of Geology at Princeton University, read a paper before the Wyoming (Pa.) Historical and Geological Society in which he described the remarkable discoveries of fossils in Patagonia. The paper is in the *Proceedings* for 1905. Some of the fossil bones taken to England by Captain Sullivan and Mr. Darwin were thought to be identical with certain European fossil remains, and it was one of the puzzles of geographical distribution how the same animals should be found in Europe and in the southern extremity of South America and yet be absent from North America. The hypotheses invented to account for this supposed paradox have been rendered superfluous by proof that the identification of the European genera was a mistake. The work of the Ameghino brothers revealed such an astonishing number of extraordinary animals that are found fossil in the rocks of Patagonia as to attract the attention of geologists and paleontologists. Dr. Scott then told of the three expeditions, 1896-99, led by Mr. J. B. Hatcher while connected with Princeton University, to acquire the necessary materials in Patagonia for a comparison between the strange fossils of that country and those of the northern hemisphere. His success was most gratifying, and his collections of fossils are of extraordinary richness and variety.

These fossils have been fully described and illustrated by Dr. A. E. Ortmann in Vol. 4 of the "Reports of the Princeton University Expeditions to Patagonia." Dr. Ortmann showed that the South American geologists had placed the Patagonian beds too low in the geological scale, and demonstrated that they are referable to the lower Miocene, and he further pointed out the close similarity between the fossils of the Patagonian beds and those of corresponding age in Australia and New Zealand. As the animals are of shore-water types which could not have crossed great depths or widths of sea this similarity is strong evidence for the former existence of a land connection between South America, Australia, and New Zealand, very likely by way of the Antarctic Continent. In connection with this statement by Dr. Scott it is interesting to mention the Tertiary fossils discovered in Graham Land by Dr. Nordenskjöld, which are identical with flora of the same geological age found in the southern part of South America.

The fossils of greatest interest secured were birds and mammals of the Santa Cruz beds which overlie the Patagonian beds, are several hundred feet in thickness, and cover a very large area of Patagonia from the mountains to the sea, also extending eastward for an unknown distance under the waters of the Atlantic. A large part of the Santa Cruz collection was obtained where the water is from 20 to 30 feet deep at high tide. The tide here has a greater rise and fall than on any other open coast.

The Santa Cruz beds are chiefly volcanic materials apparently laid upon a land surface, their stratification being largely due to the sorting action of the wind. They contain an extraordinary abundance of fossil bones which, as yet, have been found only in the more or less consolidated volcanic tuffs, which are very soft and easily eroded. This explains the occurrence of such a very unusual number of nearly or quite complete skeletons, even of the smallest or most fragile animals, that have been buried where they lay on the surface of the ground.

Dr. Scott thinks it is probable that many of the animals were caught alive, suffocated and buried in the showers of volcanic ashes and dust. To the observer who examines these fossils for the first time it is like getting into a new world where all the animals are different from the familiar types. Birds are surprisingly common in view of the usual scarcity of fossil birds. Most of the Santa Cruz birds were evidently incapable of flight, and some of them are of exceedingly large size. The most abundant and best-known genera, though flightless, are most nearly related to the South American cranes and not at all to the ostrich type. The mammals are far more important and abundant than the birds. Dr. Scott devoted most of his paper to descriptions of the rich and diversified life of Patagonia in Santa Cruz times.

ASIA.

A NOTABLE JOURNEY IN CENTRAL ASIA.—Count de Lesdain made a long journey through inner China and Tibet in 1904. He wrote from Darjeeling a brief letter to the Paris Geographical Society, on Nov. 25th last year, saying that he started on June 20th, 1904, from Peking, and first visited the still unknown desert region of Ordos, which is included between the Great Wall of China and the northern bend of the Hoang-Ho. Then he entered the region of Ala-Shan, to the west of Ordos, traversing it in various directions and discovering a large number of ruins. After making a journey to Kumbum, the explorer discovered several lakes in the still unknown part of the Central Gobi and then made preparation to cross Tibet. He first travelled through the salt waste of Tsaidam, and then made a very toilsome journey to the headwaters of the Yangtse-kiang, whence he travelled south, crossed the Brahmaputra, and finally reached Gyangtse, through which the British passed on their expedition to Lhasa. Further information from the Count is awaited with interest, as it is believed that he has procured material of much value for our knowledge of inner Asia.—(*La Géog.*, 1906, p. 170.)

JAPANESE METEOROLOGICAL SERVICE IN KOREA AND MANCHURIA.—Professor Y. Wada, who at the beginning of the Russo-Japanese war was entrusted by the Japanese Government with the organization of a meteorological service in Korea and Manchuria, has prepared an account of this service, which appears in a recent number of the *Monthly Weather Review* (No. 9, 1905). The number of stations is now twelve, including Chemulpo, Mukden, and Port Arthur. There are, in addition, four others which are at the same time marine semaphore stations. The Chemulpo Observatory is of the first order. All the stations make six observations daily, at 2, 6, 10 A.M. and P.M., 135th meridian time (east of Greenwich). Each station is provided with a Fortin barometer, an August psychrometer, maximum and minimum thermometers, Robinson anemometer with electrical attachment, wind vane, rain gauge, atmometer, Jordan sunshine recorder, and Richard thermograph, barograph, and hygrograph. At the Chemulpo station there is also an anemograph, an anemo-cinemograph, a pluviograph, a micro-seismograph, earth thermometers, etc. Daily telegraphic reports are received from the principal stations in Japan and from those in Korea and Manchuria. Further, two daily telegrams are received from some Chinese stations and from Manila. These reports suffice to enable the Chemulpo Observatory to make weather predictions and to issue storm warnings. All meteorological stations on the Korean and Manchurian coasts issue weather predictions at 4 P.M. daily. The central observatory issues storm warnings when a cyclone is expected on or near the coasts of Korea and Manchuria. Storm signals are then displayed at all the stations.

R. DEC. W.

EARTHQUAKES IN FORMOSA.—Fully adequate reports have not yet been made on the very severe earthquakes in south Formosa which occurred on March 17 and April 14. In both shocks Kagi suffered more damage than any other town. The shock of March 17 killed 1,228 persons, and injured 2,329, while 5,556 houses were totally and 3,383 partially destroyed. The disturbance of April 14 was really more severe than the earlier one, but the death-roll was small, because the people were on the alert after their earlier experiences, and a comparatively small amount of damage was done, because there was not much left to destroy. In the second shock 7 persons were killed and 35 injured at Daigo, where 400 buildings were destroyed; while in the Ajensui district the casualties amounted to 3 killed and 15 injured, 1,191 houses collapsing and 749 being partially wrecked.

EUROPE.

POPULATION OF GERMANY.—The population of Germany, according to the enumeration of December 1, 1905, is 60,605,183. The States having the largest population are Prussia, 37,278,820; Bavaria, 6,512,824; Saxony, 4,502,350; Württemberg, 2,300,330; Baden, 2,009,320; Hesse, 1,210,104; and Mecklenburg-Schwerin, 624,881. Alsace-Lorraine has a population of 1,814,626. The most populous provinces in Prussia are Silesia, 4,935,823; Brandenburg, 3,529,839; Saxony, 2,978,679; Pomerania, 1,684,125; and Posen, 1,986,267. Berlin has 2,040,222 inhabitants.—(*Geog. Zeitsch.,* No. 4, 1906, p. 226.)

CHAIR OF GEOGRAPHY IN THE UNIVERSITY OF EDINBURGH.—The Senatus of the University of Edinburgh has approved of geography as a subject qualifying for graduation in the Faculties of Science and Arts, and the University authorities have given their approval to the proposal for the establishment of a Chair of Geography. The Councils of the Scottish Geographical Society, the Royal Society, and the Edinburgh Merchant Company have expressed themselves as favourable to this object, and a Committee representative of these and other bodies has been formed to raise the necessary funds for the endowment of the Chair. An appeal has been issued to the people of Scotland for their assistance in raising funds for this endowment. About $8,000 have thus far been subscribed. The minimum amount requisite to endow the Chair is $75,000, but if this sum is not immediately forthcoming, a lectureship may be established as a preliminary. In its appeal the Committee says:

> The claims of the science of geography, as a university subject, have long been recognized by the leading German and French universities, and in recent years the universities of Oxford and Cambridge

have also established schools of geography. but as yet there is no special teaching of geography in any Scottish university. The efficient teaching of geography in our schools and colleges is one of the most urgent needs of our time, affecting the political and commercial welfare of the Empire, and it is believed that the subject cannot be satisfactorily dealt with until our universities take it up and provide, in the first place, adequate training for teachers.

THE HISTORY OF THE GEOGRAPHY OF SCOTLAND.—A recent address by Sir Archibald Geikie before the Scottish Geographical Society, published in the March number of the *Magazine,* outlines in an interesting style the main events in the geological history upon which the present scenery of Scotland depends. It is a scientific paper by the master who is best able to treat the subject, and a striking illustration of the relation of geographical features to geological changes, even to those of the most remote past.

A part of northwestern Scotland has the oldest-known landscape in Europe—a land surface so ancient "as to date back to a time before the earliest-recorded traces of living things had appeared upon the surface of the earth." This land surface was buried beneath a great thickness of strata, by the partial removal of which the fossil landscape has been brought to view, and after millions of years of preservation again become a land surface. After the burial of this ancient land beneath sedimentary deposits there came a period of great mountain growth, upheaving a lofty mountain range wider than the mainland of Scotland, and stretching for 1,600 miles from the west of Ireland, through Scotland and Scandinavia to the Arctic. In the course of this the rocks were not only folded, crumpled, and greatly altered, but broken along nearly horizontal planes or overthrust faults, and pushed bodily westward, bringing younger rocks above older ones. Some of these blocks "were thrust forward for a distance of ten miles or more."

Since this period of mountain-folding the rocks have been subjected to denudation and the mountains "cut down to their very roots." Again and again large areas have been down to sea-level, and even placed below the sea, receiving deposits of younger strata, remnants of some of which stand as outliers in favourable situation. Parts of the history are obscure, and some portions cannot be deciphered at all, for there are many gaps; but enough remains to permit the unravelling of the main threads of the history by which the landscape of to-day has been evolved. Not the least interesting of the events is the appearance of volcanic activity in the region, not once merely, but in several successive periods, the last and greatest being in Tertiary time.

Each of the events has stamped its mark on the present topography. The difference between Highlands and Lowlands; the peaks and valleys; the crags and terraced volcanic tablelands; the lochs and firths: in short, both the general and the detailed features of this interesting land can be understood only in the light of geology. Even the modern economic development of Scotland is dependent upon geological changes of the past. For example, the deposit of coal, which is of such vital importance to Scotland, was made possible by geological changes; but even more than that, had it not been

for the effect of subsequent dislocation of the crust, whereby the coal-fields were let down many hundreds of feet, and were then protected from denudation, these important elements (coal and iron) in our national resources might have been largely or wholly removed, as has happened in Ireland, where no such fortunate series of dislocations occurred to retard or prevent the destruction.

This history, well illustrated by maps and half-tones, is told in a most fascinating way, and well warrants Geikie's statement that

it impresses upon us how vague and incomplete our conceptions of landscape must be, unless we acquire some knowledge of the origin and relations of the different topographical features which give to landscape its distinctive characters, its variety, and its charm.

It is encouraging to find such papers in geographical magazines, as witness that modern scientific geography is winning for itself a place in English-speaking countries.

R. S. T.

ENCOURAGING FOREIGNERS TO VISIT SPAIN.—The Spanish Government has appointed a National Committee to have charge of the work of encouraging foreigners to visit that country. The Commission is preparing to distribute in foreign lands itineraries, following which the chief national monuments and art works, the finest scenery, etc., may be visited most easily and comfortably. It is also consulting with the railway companies with a view to establishing special tariffs and fast, comfortable trains. It is further designed to bring about the improvement of service of all kinds relating to travellers in every town where tourists are likely to stop.—(*Daily Consular Reports.*)

STUDYING THE LAGOON OF VENICE.—A systematic study of the phenomena relating to the lagoon of Venice has been undertaken by the Venetian Institute of Science, Letters and Arts. The work now under way is in charge of a special Commission. The first investigations, relating chiefly to the tidal waves in the upper Adriatic, together with the rivers flowing into it and the lagoon of Venice, are in charge of Dr. Giovanni Piero Magrini.

IMPOVERISHING THE PYRENEES.—French newspapers and scientific journals recently reiterated the statements that the high pastures among the Pyrenees were being destroyed by the excessive number of sheep kept on them, and that the inhabitants were continuing to deforest the mountains and to burn the underbrush over large areas. The result is said to be that the pastoral industry has been declining; and the diminution of the forests has caused faster melting of the snows and an increase of the destruction wrought by torrents in the lower valleys and among the foothills. The *Bulletin* of the Geographical Society of Languedoc (Quatrième Trimestre, 1905) says that the people of the lowlands complain that they are suffering from these practices of the mountaineers. The Bordeaux Association, whose special interest is the management of the mountain forests, undertook to restore the pasturage on 2,000 hectares in the valley of the Neste River. This work was very successful in the past year, and many mountaineers are profiting by the object-lesson given to them. Another mountain community has asked the Association's advice in efforts to improve the condition of its pastures; and still another, in the valley of the Adour, has stopped the practice of overgrazing. The mountaineers are becoming more and more inclined to substitute milch cows for sheep and goats. Count de Roquette strongly favours arboriculture as a means of improving the condition of the mountain-dwellers, and various means of reforestation by private enterprise and under Government control were considered at a recent meeting of the Bordeaux Association.

RUSSIAN POLITICS AND CLIMATE.—In an address on *The Geographical Foundations of Russian Politics,* by Dr. Charles Sarolea, delivered before the Royal Scottish Geographical Society, at Edinburgh, February 18 last, reference was made to certain climatic features which have been important controls in Russian national life. The unity of the infinite plain is rendered more striking because of the unity of the climate. In summer there is a unity of continental summer heat. In winter there is a unity of snow, which buries the whole country from Poland to Siberia. The traveller can then go on his sledge for a distance of 6,000 miles from the Baltic to the Pacific; from Archangel to Astrakhan. In the extreme north are the frozen tundras, inhabited only by the Laplander and the reindeer. In the extreme south are the deserts of salt, crossed only by nomadic tribes and camels. In between European Russia is divided into three zones: the region of primeval forests in the north; the region of grassy steppes in the south; the intermediate region of arable land, the famous "black soil," fertile to a degree, yielding abundant harvests. The forest-dwellers have need of the agricultural products of the black soil, the granary of Russia. The farmers need the fuel and building material and moisture of the forest. The grassy steppe is the hinterland of the black soil. The arable land yearly encroaches on the steppe. Throughout these three zones Russia is an agricultural community.

The irresistible impulse towards summer climes has been natural and intense in the Russian people, "because no other nation has been so distinguished by nature, no nation has been so entirely bereft of heat and light." The Crimea and Transcaucasia, the southern provinces, have always been to Russia what Switzerland and the Riviera, Italy and Greece, are to an Englishman or a Teuton. This "heliotropic" instinct is like that which turns a flower toward light and heat.—(*Scottish Geogr. Mag.*, April, 1906.) R. DeC. W.

POLAR.

CAPTAIN MIKKELSEN'S EXPEDITION.—The Anglo-American Arctic Expedition, in command of Captain Ejnar Mikkelsen, has started for its field work. Captain Mikkelsen sailed from Victoria, B. C., on May 20 on board the schooner *Duchess of Bedford,* formerly a sealer, which he had purchased. The vessel is built of camphor wood without outside planking of kayacki wood, and is sheathed, above and below the water-line, with gum-wood, the bow being further protected with iron plates and two bulkheads and beams in the hold to withstand ice pressure. The schooner's length is 67½ feet, with 8-feet draught, and, with the additional strengthening which Captain Mikkelsen gave her, she is well adapted for Arctic work.

The scientific work which the expedition has in view includes tidal observations along Alaska and Banks Land, geological, ethnographical, and zoological collections among the western Parry Islands, meteorological observations during two years, a line of soundings northwest from Prince Patrick Island, and a sledge trip on the Arctic Ocean west from Banks Land for the purpose of locating the edge of the continental shelf and discovering new islands, if there is a western extension of the Parry archipelago.

Capt. Mikkelsen took with him in his ship the following persons: Mr. Leffingwell, geologist; Mr. E. Ditlevsen, naturalist and artist; Dr. George P. Howe, surgeon; and in the crew J. Edwards, mate; Mr. Parker, second mate; E. Gilmour, cook; Chr. Thursen and T. Storken, sailors.

Mr. V. Stefansson, ethnologist, started north from Athabasca Landing, May 12, to descend the Athabasca, Slave and Mackenzie Rivers to the Arctic Ocean, where he will meet the ship party. Mr. Stefansson expects to have an opportunity on the land journey to make desirable studies in his line of work. He will reach the Mackenzie delta about six weeks before the arrival of the vessel, and will improve this time to make collections and studies for comparison with results to be obtained later among the Parry Islands.

Captain Mikkelsen on his journey north will make a short stop at Kadiak Island and then cruise along the coast of eastern Siberia, where he expects to purchase fifty or sixty dogs and one or two ponies. He hopes to enter Bering Strait about Aug. 1st, and push along the Alaskan coast in the shallow coast waters, thus avoiding the heavy pack-ice. Passing Point Barrow he will give what time may be spared to tidal observations, especially between Harrison Bay and Herschel Island, where there seems to be a sudden change of twelve hours in the tide constant. He hopes to reach the mouth of the Mackenzie about Aug. 20.

The united party of ten men will then sail eastward past Cape Bathurst, cross over to Prince of Wales Strait, and make a supply dépôt near Princess Royal Island. Retracing its course, it will establish winter quarters in Minto Inlet on the west coast of Prince Albert Land. Hunters will be sent out to secure fresh meat for the party and food for the dogs. As much scientific work as possible will be in progress during the winter.

In the spring of 1907 a party of two men, replenishing its supplies from the dépôt near Princess Royal Island, wil endeavour to cross over to Melville Island and thence to Prince Patrick Island. If this party succeeds it will be the first to pass through the interior of Prince Albert Land, Banks Land, and Melville and Prince Patrick Islands, four of the larger islands in the archipelago. The party will also try to survey the unexplored northwest coast of Prince Patrick Island, and hopes to make a sledge journey on the sea about 75 miles to the northwest, making soundings through the tidal cracks, and thus obtaining an idea of the configuration of the sea-bottom. It is hoped that this party will be back at headquarters early in June, where the other scientific workers will have been engaged in extending their knowledge by trips from the vessel.

As soon as the ice has sufficiently opened, the vessel will cross over to Nelson Head at the south end of Banks Land, and thence sail up the west coast through the channel between the pack-ice and the shore to Burnet Bay, where she will unship the provisions and remain either until the autumn of 1907 or, if supplies permit, until the summer of 1908, being then sent home.

In the spring of 1908 a party of three men, the dogs, and the pony, with provisions for 140 days, will start over the sea-ice in a W. N. W. direction, making soundings as frequently as possible and keeping on the same course until the edge of the continental shelf is passed, land is found, or the position of 150° W. Long. and 76° 30′ N. Lat. is reached. If the edge of the continental shelf is reached, the party will endeavour to trace it to the westward. If land is found, it will be explored as far as the supplies permit. Provisions will be economized by killing draft animals when their services may be dispensed with; the weight drawn by each animal will be kept as even as possible. When it is necessary to return to the coast the party will retreat to Wrangel Island or to the nearest Alaskan coast, as circumstances may decide. The observers left at Burnet Bay will be taken home on the ship, but the sledge party will have to rely on the whalers along the Alaskan coast for passage home, unless they should arrive at Wrangel Island in time to meet their own vessel, which will call there on the way south.

Mr. Stefansson especially hopes that the field may be fruitful in ethnological collections, half of which have been pledged to Harvard and a quarter to Toronto

University for assistance rendered by these institutions to the expedition. He will study the old Eskimo remains in the western part of the Parry archipelago and the natives of to-day, if any are living there. He is a graduate student and an assistant Instructor in Anthropology in Harvard, and has twice held the Hemenway Fellowship in Anthropology. He spent the summer of 1904 and 1905 in Iceland, and brought home a large number of skulls and skeletons of the inhabitants of heathen times. These are now in the Peabody Museum.

Captain Mikkelsen's scheme of exploration covers a great deal of ground; but even if the conditions permit him to carry out only a part of his programme, the results will place his among the notable Arctic enterprises.

METEOROLOGICAL STATIONS IN THE ANTARCTIC.—The Argentine Government intends to maintain the scientific observation station started by the Scottish Antarctic Expedition on the South Orkneys, a little north of the Antarctic area, for at least another year, which will complete a series of observations extending over four years. At the end of December last the Argentine steamer *El Austral* left Buenos Aires with three scientific observers under the lead of Señor Lind to relieve the observers at Scotia Bay, South Orkneys. From that point the vessel was to go to Ushuaia, in Tierra del Fuego, where Mr. Angus Rankin, formerly in charge of the Ben Nevis Observatory, with three companions, had gone to await the steamer. With these observers on board, *El Austral* was to steam south to Wandel Island, in the Graham archipelago, where Rankin will establish a new meteorological and magnetic station in the Antarctic for the Argentine Government. Upon the return of the vessel to Buenos Aires, Mr. Mac Dougall, a former member of the Ben Nevis force, will be sent to South Georgia, where a second Antarctic station will be found. Thanks to the liberality of the Argentine Government, the meteorological and magnetic conditions of this part of the Antarctic will be fully investigated.—(*Geog. Zeitsch.*, No. 4, 1906.)

VARIOUS.

GREAT CANALS OF THE WORLD.—The U. S. Department of Commerce and Labor has issued a monograph on "Great Canals of the World" prepared in the Bureau of Statistics. It brings together a large amount of information on the great canals, with special reference to the Suez, Cronstadt and St. Petersburg, Corinth, Manchester, Kaiser Wilhelm, Elbe and Trave, Welland, Sault Sainte-Marie and Canadian canals. The interior canal systems of various countries are also adequately treated, and with much information as to their history, cost, freight rates, and the commerce that passes through them. This is a valuable compilation, relating to one of the greatest factors in international transportation.

FORESTS AND RIVERS.—At the meeting of the International Navigation Congress, held at Milan recently, the question of the influence of deforestation upon the régime and discharge of rivers was again discussed. There was no difference of opinion concerning the fact that improvident deforestation has markedly changed the water supply of neighbouring rivers; that brooks have disappeared; many rivers are less useful as sources of power; and that large rivers are more liable to flooding on the one hand and periods of low water on the other. Many striking examples were cited of the deleterious results of cutting down forests, especially in hilly districts. Thus, in the commune of La Bruguière, forests on the slopes of the Montagne Noire (Tarn) were cut down. In consequence, a brook at the foot, whose water had been used for driving some mill-wheels, dried up in summer to such an extent that it was of no use as water power, while in winter floods caused great damage. After reforestation, the brook became more regular, and was once more available for power. The floods of winter also ceased. In Switzerland, in the canton of Berne, a spring which had ceased to flow started up again after reforestation of a mountain-side. Later, when the trees were again cut down, the spring almost disappeared. In the Kazan district of Russia, where formerly seventy water-mills were at work, and where most of the forests have been cut down, less than half of these mills are now running, and most of these on half-time only, being idle in summer for want of water. In winter the rivers are impetuous torrents, breaking up mill-dams and doing other damage. In Sicily, in the province of Messina, the river-beds have been raised by the stones and earth carried down by the torrents since deforestation, and great damage has been done by floods.—(*Nature,* Vol. 73, 1906, 319-320.) R. DeC. W.

VARIATIONS OF GLACIERS.—The tenth Report of the *Commission Internationale des Glaciers* shows that glaciers are still diminishing in those places where they have been studied. Not one of ninety glaciers in the Swiss Alps shows an advance, thus confirming the general results of the past seven years. In the Savoy Alps and in the Pyrenees the shrinkage continues. With few exceptions the Norwegian glaciers have retreated. During the past year more than 110 glaciers in the Pamir have been visited by M. Fedtchenko, and all appear to be diminishing. Similarly there is retreat, with few exceptions, in the northwestern United States and western Canada. In Africa the amount of snow in the crater of Kibo has not increased since 1901, according to Uhlig. Thus the retreat of the glaciers which began about forty-five years ago still continues. The slight rally occasionally noted during the past decade has been overpowered. R. DeC. W.

GLACIAL EROSION.—In a splendidly illustrated article (*Journ. Geol.,* Vol. XIV, 1906, pp. 22-54) E. C. Andrews describes the evidence of profound glacial erosion in New Zealand. U-shaped main valleys, with flat bottoms, truncated spurs, steepened lower slopes, and hanging tributary valleys, are both described and shown in excellent half-tones. These features and the fiords he ascribes to ice-erosion, as others have done for similar phenomena in the Alps, Norway, Rocky Mountains, Sierra Nevada, and Alaska; and few if any physiographers will consider that he has failed to establish his thesis.

Besides this description and interpretation, Andrews advances and discusses the theory that during stages of maximum glaciation or "ice-floods" the glaciers so deepen and broaden their valleys as to produce "too great breadth and too slight a grade to admit of further corrasion by the present insignificant representatives of the former glaciers." In this connection he considers the difference in behaviour of a river in flood and in quiet stage as a basis for understanding the difference in behaviour of flowing ice-sheets in their flood and shrunken stages. This is an important consideration, and Andrews makes a strong case of it. It supplies food for thought for those geologists who, witnessing the feeble ice-erosion of weak glaciers, at their ends—the points of greatest weakness—argue from these observations that consequently great glaciers several thousand feet deep and moving rapidly are protecting rather than eroding their beds. It is somewhat like arguing that since a small brook in its shrunken summer stage is not eroding its bed, therefore the Colorado River could not have formed its cañon. Profound glacial erosion is now established; it remains to discover the processes and the nature and causes for variation in the work of this important agent in land sculpture, upon which so much of our grandest scenery depends.

R. S. T.

Professor R. S. Tarr of Cornell University will conduct an expedition to Alaska during the coming summer, with four assistants and a number of packers. This expedition will study the Malaspina and Bering Glaciers and make a reconnoissance survey of the bed rock geology of the region between Yakutat and Controller Bays.

U. S. BOARD ON GEOGRAPHIC NAMES.—DECISIONS May 2, 1906:

BLACK: mountain, Mohave county, Ariz. (Not Ute.)

BOOT: island, south of Ile Richard, Mackinac county, Mich. (Not Bootjack.)

CARBON: peak, Elk mountains, Gunnison county, Colo. (Not Castle Peak, Mount Carbon, nor Mount Ohio.)

CORYELL: island, east of Ile William, Mackinac county, Mich. (Not Ile Richard nor Coryell's.)

CUBE: point, northwestern part of Marquette island, Mackinac county, Mich. (Not Cube's, Cubes, nor Kechetotawnon.)

DEAD: mountains, San Bernardino county, Calif. (Not Black.)

DUCK: bay, eastern shore of Marquette island, northwest of Wisner point, Mackinac county, Mich. (Not Wisner's nor Muscallonge.)

ELK POINT: township and village, Union county, S. D. (Not Elkpoint.)

FOX: peak, on line between Granite and Ravalli counties, Mont.

GOVERNMENT: island, east of La Salle island, Mackinac county, Mich. (Not Ile William nor Ile Williams.)

GRAVELLY: island, east of Boot island, Mackinac county, Mich. (Not Ile Aux Cochons.)

HARNEY: peak, Black Hills, Pennington county, S. D. (Not Harney's.)

ISLAND No. 8: north of Ile William, Mackinac county, Mich. (Not Ile Isidore.)

MACKINAC: bay, east of Hessel, between south shore of Upper Peninsula and Marquette island, Mackinac county, Mich. (Not Duck nor Mackinaw.)

MARBLE: island, Sea Otter sound, southeastern Alaska. (Not Fox.)

MOHAVE: mountains, east of Colorado river, Mohave county, Ariz. (Not Chemehuevis nor Chimhuevis.)

MUSCALLONGE: bay, between Conners point and Wisners point, Mackinac county, Mich. (Not Big Muscallonge.)

ORCA: bay, Prince William sound, Alaska. (Not Cordova.)

PALISADES PARK: borough, Bergen county, N. J. (Not Palisade Park).

POQUOSON: river, emptying into Chesapeake bay, Va. (Not Pocoson, Pocosin, nor Poquosin.)

RACETRACK: peak, at the head of Boulder creek, latitude 46° 21′, longitude 113° 02′, Granite county, Mont. (Not Mount Powell.)

SAUK: point, near Baraboo, Sauk county, Wis. (Not point Sauk nor Sauk Summit.)

TSADAKA: creek, tributary to Matanuska river, 20 miles above Knik arm of Cook inlet, Alaska. (Not Moose.)

TUNP: mountain range above Rock creek, west of Hams Fork plateau, east of Sublets range, Uinta county, Wyo. (Not Campbell, Seedskeedee, nor Tetlick.)

WHITEFISH: point, west of Prentiss bay, Mackinac county, Mich. (Not Whist island nor Whitefish island.)

ARIZONA.

Grand Canyon of the Colorado, Coconino County.

Ariel: point.
Boucher: trail.
Boulder: creek.
Brahma Temple: peak.
Bright Angel: canyon.
Bright Angel: creek, flowing into Colorado river.
Bright Angel: point.
Buddha Temple: peak.
Cameron: trail.
Cedar: spring.
Cheops Pyramid: butte.
Clear: creek, branch of Colorado river.
Coconino: plateau. (Not Colorado.)
Cocopa: point.
Confucius Temple: butte (one of Twin Buttes.)
Cope: butte.
Cremation: creek.
Crystal: creek, flowing into Colorado river. (Not West Fork.)
Dana: butte.
Deva Temple: peak.
Dragon: creek, flowing into Crystal creek. (Not East Fork.)
Dragon Head: butte.
Dripping: spring.
Garden: creek, flowing into Colorado river.
Grama: point.
Grand Canyon: canyon of the Colorado river.
Granite: gorge.
Grapevine: creek.
Greenland: spring.
Haunted: canyon.
Hermit: basin.
Hermit: creek.
Hindu Amphitheatre: basin. (Not Hindoo.)
Hopi: point. (Not Rowes.)
Horn: creek.
Horus Temple: peak.
Isis Temple: peak.
Komo: point.
Little Dragon: plateau.
Lyell: butte.
Manu Temple: butte.
Maricopa: point. (Not Sentinel.)
Marsh: butte.
Mencius Temple: butte (one of Twin Buttes).
Mohave: point.
Monument: creek.
Natchi: point.
Newton: butte.
Obi: point.
O'Neill: butte.
Osiris Temple: peak.
Outlet: canyon.
Outlet: spring.
Oza: butte.
Phantom: creek, flowing into Bright Angel creek. (Not West Fork.)
Pima: point.
Point Sublime.
Ribbon: falls.
Roaring: springs.
Salt: creek.
Shiva Temple: peak.
Shoshone: point. (Not Cremation.)
The Colonnade: high terrace.
The Dragon: plateau.
The Transept: deep canyon.
Tiyo: point.
Tonto: trail.
Tower of Ra: butte.
Tower of Set: butte.
Trinity: creek, flowing into Colorado river.
Tuna: creek.
Walhalla: plateau. (Not Greenland.)
Walla: valley.
Yaki: point.
Yavapai: point.
Yuma: point.
Zoroaster Temple: peak.
Ottoman Amphitheatre: basin.

NEW MAPS.

AFRICA.

GAMBIA.—Gambia. Scale, 1:1,000,000, or 15.7 statute miles to an inch. Compiled in the Topographical Section, General Staff. London, 1905. (Price, 1s.)

The positions of villages, rivers, and hills are only approximate, as no part of this region has been surveyed. The place-names in the neighourhood of the Gambia River are very numerous.

AMERICA.

U. S. GEOLOGICAL SURVEY MAPS.

UNITED STATES.—Kentucky. Sketch Map of Log Mountain Mining District. Scale, 1:45,000, or 0.71 statute mile to an inch. U. S. Geol. Sur., Prof. Paper No. 49. Washington, 1906.

Shows the principal coal-beds, the location of the mines, prospects and outcrops, and, by red lines, the structure of that part of the basin.

UNITED STATES.—Kentucky. Geologic Map of a Part of the Cumberland Gap Coal Field. Two Sheets. Scale, 1:45,000, or 1:071 statute mile to an inch. U. S. Geol. Sur. Prof. Paper No. 49, Washington, 1906.

Nine tints showing geological formations. The position of coal outcrops, mines, and prospects is indicated.

Geologic Atlas of the United States. Washington, D. C., 1905.

No. 135. Nepesta Folio, Colorado.

ALASKA.—Outline Map of Alaska showing Location of most important Roads as proposed by the Board of Road Commissioners for Alaska. Scale, 1:2,500,000, or 39.4 statute miles to an inch. War Department, Washington, D. C., 1905.

Shows in colours the constructed and proposed roads, trails, and telegraph lines. The map accompanies the first annual *Report* of the Board of Road Commissioners for Alaska, in which existing roads are described and plans for the improvement of roads and trails are given. Nearly all the proposed roads are to connect mining centres with navigation on the rivers.

BRASIL.—Vorläufige Skizze der Reisewege der Expedition Koch am oberen Rio Negro u. Yapura. Scale, 1:4,000,000, or 63.1 statute miles to an inch. *Zeitschrift* of the Berlin Geographical Society, No. 21, 1906.

Illustrates Dr. Theodor Koch's four journeys in 1903-05 on the upper affluents of the Rio Negro and along nearly the entire course of the Rio Yapurá. The map furnishes considerable material for laying down the courses of the tributaries of the Rio Negro. It shows the position of the few white settlements and the Indian villages, and marks many rapids and waterfalls in the rivers.

ASIA.

SIAM.—Carte du Siam. Scale, 1:6,000,000, or 94.6 statute miles to an inch. By E. Robert. *Bulletin* of the Royal Geographical Society of Antwerp, No. 3, Vol. 29, 1906.

A large part of this number of the *Bulletin* is devoted to a comprehensive study of Japan. The map shows in red the boundaries of Siam, as fixed by the treaty of Feb. 15, 1904, with hydrography in blue and railways in operation or projected in black.

EUROPE-CENTRAL.—Neue Uebersichts-Karte von Mittel-Europa. Scale, 1:750,000, or 11.8 statute miles to an inch. Sheets G7, Banjaluka; H7, Orsova; G8, Cattaro; H8, Skuplje. K. u. K. Militär-Geographisches Institut, Vienna.

These are the first four sheets of the revised edition of one of the finest general maps of Central Europe before the public. The area of this very useful map is being extended in the new edition so as to include all that part of Europe lying between the Baltic and Constantinople and between the Rhone and the Crimea. When completed the map will consist of forty sheets. The sheets are being produced in two styles: One shows relief in brown shading combined with contours of 300 meters' interval, and is the style that will be preferred by experienced map-readers; the other generalizes relief by light-and-shade effects, elevation of contours being indicated on the margins, though contours are not marked on the sheets.

FRANCE.—Carte des Gisements de Coquilles Comestibles du Golfe du Calvados. Scale, 1:150,000, or 2.38 statute miles to an inch. By Joseph Guérin. *Bulletin* of the Monaco Oceanographical Museum, No. 67, Monaco, 1906.

Shows the distribution of oysters and other shell fish along this part of the French coast. Two insets show plans of the oyster beds at Courseulles in 1887 and 1905.

FRANCE-GERMANY.—Carte Générale des Vosges et des Regions voisines. Publiée sous le patronage du Syndicat d'Initiative des Vosges et de Nancy. Scale, 1:320,000, or 5.05 statute miles to an inch. By Commandant Frézard. J. B. Schmitt, Belfort, 1905. (Price 1fr. 50c.)

Lithographed in five colours: red for places, heights in figures, and routes; black for text and railroads, blue for water, green for boundaries, and brown wash drawing for topographic relief. The map is not drawn with superior refinement, but it clearly conveys an uncommonly large amount of information. Thus it has six distinctive marks for settlements and six for different kinds of land highways. It gives the French spellings of names, though many of them are not now the official spellings. On the margin the German spellings with French equivalents are given. The map will be especially useful to automobile and bicycle tourists.

GERMANY.—Versuch einer Karte der Alten Handelsstrassen in Deutschland. Scale, 1:1,500,000, or 23.7 statute miles to an inch. By F. Rauers. *Pet. Mitt.*, Vol. 52, No. 3. Justus Perthes, Gotha, 1906.

Illustrates a paper by Mr. Rauers on the history of the old trade-routes in Germany. It shows the network of roads along which freight was carried in the Middle Ages and later, and distinguishes between the main roads and their tributaries. Among the large number of towns about 300 are especially indicated as centres of the carting trade.

GREAT BRITAIN.—Environs of London. Scale, 1 statute mile to an inch. John Bartholomew & Co., London, 1906. (Price, 1s.)

This fine map, chiefly for tourists and cyclists, is an excellent guide to the suburbs of London. Railroads, main and cross roads, woods, country seats, towns, and even many houses are shown with great distinctness. While London is coloured gray, the environing areas have a white base, on which is imposed, in several colours, the desired information. Surface forms are not indicated, the design of the map being to show merely the geographical relation of all towns and private estates to London and the best means of reaching them.

GREAT BRITAIN.—Maps Illustrating the Physical Evolution of Scotland. Scale, 90 statute miles to an inch. By Sir Archibald Geikie. *Scot. Geog. Mag.*, Edinburgh, March, 1906.

Eight maps on one plate illustrating Scotland as it was in the various geological epochs. Brown tints on each map show the land that is supposed to have existed at the periods mapped. The sea in each period is coloured blue, and the regions for which data are wanting are left uncoloured. Each map shows the present outlines of Scotland, and the series represents the physical evolution from the time of the Torridonian sandstone, still preserved in northeast Scotland as a part of the oldest-known landscape of Europe, through early Tertiary time.

SWITZERLAND.—H. Kümmerlys Touristenkarte von Graubünden. Scale, 1:300,000, or 4.7 statute miles to an inch. Geographischer Kartenverlag, Bern, 1905. (Price, paper 2.50f., linen 3.50f.)

Based on the topographic survey of Switzerland, with the features of the relief effectively accentuated by light and shade. Leading towns are in bold type, railroads in red, and the names of the principal glaciers and many heights are given. Valleys are differentiated from other topography by a green tint. Though most of the area covered is in German Switzerland, a considerable number of spellings of place-names do not follow the usual German orthography. The map will be extremely useful to tourists in that region.

SWITZERLAND.—Karte von Bodensee und Rhein, mit den angrenzenden Gebieten von Baden, Württemberg, Bayern, Österreich und der Schweiz. By Professor F. Becker. Scale, 1:125,000, or 1.9 statute mile to an inch. Verein für Geschichte des Bodensee's und seiner Umgebung und dem Bodensee-Verkehrsverein. Bern, 1905. (Price, 2 M.)

A very fine specimen of map-making. Contours show the level of the floor of Lake Constance.

OCEAN ROUTES.

A. BARENTS AND KARA SEAS.—Die Fahrt nach dem Ob und dem Jenissei im Jahre 1905. No scale. Annalen der Hydrographie, No. 5, 1906, Berlin.

B. SIBERIA. Der Jenissei von der Mündung bis zum Kap Gostinny. Scale, 11 kilometers to an inch. Annalen der Hydrographie, No. 5, 1906.

C. SIBERIA.—Lukowaja Protoka. Scale, 500 meters to an inch. Annalen der Hydrographie, No. 5, 1906.

The above three maps illustrate an account by Mr. J. Hermann of the remarkable journey of more than twenty vessels in 1905 in the service of the Russian Government through the southern part of Barents Sea and Kara Sea to the Ob and Yenesei Rivers. A shows the courses followed by the vessels of the expedition from Värdo and Catherine Harbor to the Siberian Rivers; B is a survey of the lower Yenesei based upon the Russian Admiralty chart, as revised by Captain Berg of the steamer *Sweaborg*. C is a survey with numerous soundings of Lukowaja Strait.

WORLD.—Transportation Routes of the World. (Mercator Projection.) Department of Commerce and Labor, Bureau of Statistics, Washington, 1905.

Illustrates a monograph on the "Transportation Routes and Systems of the World." The pamphlet says that the map is intended to present "a bird's-eye view of the great land and water transportation routes." The great river routes which extend navigation from the sea far inland are not shown. River routes, of course, cannot be completely ignored in a map adapted to show the great highways of commerce.

ATLASES.

ANDREES ALLGEMEINER HANDATLAS.—In 139 Haupt und 161 Nebenkarten; nebst vollständigem alphabetischem Namenverzeichniss von etwa 240,000 Namen. Fünfte, völlig neubearbeitete und vermehrte Auflage. (Lieferungen 19-30.) Herausgegeben von A. Scobel. Velhagen & Klasing, Leipzig, 1906. (Price of complete work, M. 28.)

A little more than half the sheets of the new addition have now been published. Sheet 53-54 (Provinz Sachsen und Herzogtum Anhalt) illustrates finely the clear and easily-read printing of a large number of place-names imposed upon mountain hachuring. No atlas has done more than Andree's to improve the legibility of atlas sheets that are thickly covered with detail. The Route Chart of the Atlantic Ocean (Sheet 23-24) shows the cable routes and steam routes and nationalities of the various steamship lines, together with some of their land connections. A number of the short African railroads extending into the interior are shown, but not one of the lines along the Gulf of Guinea, and the railroad from Buluwayo to Victoria Falls is not indicated, though the sheet bears the date of August last year, the very month that the British Association visited the Falls by rail. Among the especially attractive sheets is Nos. 5-6 (Nordpolargebiete), which, with its four inset maps, forms a splendid cartographic summary of our knowledge of the Arctic regions. American mapmakers who have recently represented certain unexplored Arctic coasts as though they had been surveyed would do well to observe the care with which this map distinguishes between known and unknown coastlines. The sheet showing southern Canada was issued just before the new Provinces of Alberta and Saskatchewan were formed out of a part of the North West Territories, and the new sheet, therefore, does not give the latest political sub-divisions. The large fraction of the new edition now published shows that it will enhance the great reputation already enjoyed by this Atlas.

ATLAS OF THE WORLD'S COMMERCE.—Compiled from the latest Official Returns at the Edinburgh Geographical Institute. Edited by J. G. Bartholomew. (Parts 2-4.) George Newnes, London, and Frederick Warne & Co., New York, 1906. (Price per Part, 25 cents.)

The two sheets contain six cotton and seven sugar maps. The larger map on the cotton sheet shows the areas of cultivation in the producing countries, distinguishes the areas that are being cultivated experimentally, and shows the direction taken by exports. The insets show the countries of importation and the centres of cotton manufacture; the distribution of the crop in the United States, coloured according to the number of bales per square mile; and distribution of the crop in China, Lower Egypt, and India, distinguishing between areas of large and small production. The reverse of the sheet is filled with statistical diagrams and a general summary relating to cotton. The same kinds of information concerning sugar fill the second sheet. The description of the "Commodities of Commerce" is continued from *Bluestone* to *Chicory,* with 4 diagrams in the text. The opinion has already been expressed in the BULLETIN that this Atlas is to be highly recommended to advanced classes in commercial geography and to merchants as a superior reference volume.

The four double-page maps in Parts 3 and 4 treat the topics of Tea, Tobacco, Wine and Iron. The sheet given to each commodity shows the areas of production all over the world, the main lines of export transportation, and the importing countries, distinguishing between regions of large and small importation; also with larger-scale maps showing in more detail the regions of largest production. The back of each sheet is filled with statistical diagrams and descriptive letterpress giving the most important facts of production and consumption. The dictionary of the commodities of commerce is extended in these two parts from *Chillies* to *Gurjun Oil.*

ATLAS ZUR KIRCHENGESCHICHTE. 66 Karten auf 12 Blättern. Von Dr. Karl Heussi und Hermann Mulert. Verlag von J. C. B. Mohr (Paul Siebeck), Tübingen, 1905. (Price, 4 M.)

The practical purpose of this little atlas is to facilitate the study of Church history. There are not a few text-books on the history of the Christian Churches, but this is the first time that an atlas has been compiled as a cartographic aid in the pursuit of this study. It is to be welcomed, therefore, as a new and convenient source of information; and all the more because the maps have been very carefully prepared, though, of course, no map product can claim perfection.

A brief description of one plate will show the general plan of the work. On each plate are grouped a number of small maps relating to the general topic to which it is devoted. Plate IV, for example, deals with Church history in eastern Europe, and includes the following maps: (*a*) Missions among the Slavs, 867; (*b*) Position of the Church in east Europe about 1090; (*c*) Distribution of the Church in the Balkan Peninsula by the ordinance of Justinian; (*d*) The Church in the Lower Danube lands at the beginning of the 14th century; (*e*) Advance of the Latin Church in Russia and on the Black Sea in the 14th century; (*f*) Boundary between the Eastern and Western Churches before 1386; (*g*) The Eastern Churches about 1900.

It would seem desirable, at a later printing, to add to this useful work two or three sheets relating to modern missions.

HISTORICAL AND MODERN ATLAS OF THE BRITISH EMPIRE. By C. Grant Robertson and J. G. Bartholomew. 64 map plates and 19 insets, Gazetteer, Statistics, etc. Methuen & Co., London, 1905. (Price, 4s. 6d.)

Excellent maps, designed to enable teachers and pupils to examine separately or to compare with one another the historic, physical, economic, or political factors that have helped to make the British Empire what it is. The modern physical and economic maps are meant to serve for the geographical text-books, while the historical maps are intended to illustrate the whole course of British history from the point of view of Imperial development. The final plate is a diagram showing the chronology and expansion of the British Empire.

BOOK NOTICES.

Economic Geology of the United States. By Heinrich Ries, A. M., Ph. D., Assistant Professor of Economic Geology at Cornell University. xxii and 436 pp. The Macmillan Company, New York, 1905. (Price, $2.60.)

The non-metallic minerals are treated first in this work, both on account of their greater simplicity and the superior value of their output. It is difficult to compress so much material within one volume, but Dr. Ries has gained space by omitting matters of geological introduction, rightly assuming that these belong to earlier studies. The title is representative, as reference is made only to such foreign minerals as serve for chief sources of supply in this country. There are about 100 figures in the text, chiefly maps and sections, and 25 plates, mostly half-tones.

The treatment begins with coal. That so large a subject is put into 36 pages shows the rigid limits of space to which the author of a text-book is subject. The discussion is compact and comprehensive, even though short, and includes the following topics: definitions of kinds, analysis of thirty-one representative samples, origin and conditions of accumulation, structural features of coal-beds, descriptions of coal fields, production by years, States, and fields, as well as of leading countries, and bibliography. The last is a feature of all the chapters. In 1903 the United States produced 357,000,000 short tons, as against 257,000,000 for Great Britain and 178,000,000 for Germany. No other country produced 50,000,000 tons.

Building-stones are treated under the general heads of colour, texture, density, hardness, strength, porosity, and rate of absorption, resistance to frost and resistance to heat. The leading rocks are described under the head of granites, limestones and marbles, serpentine, sandstones and slates.

Under clays the author's reserve is well shown by the fact that but 17 pages are given to the subject, although Dr. Ries is the leading authority and most voluminous writer on clays in the United States. A sample of the compactness and fulness of the work may be found in the brief but informing definitions of numerous varieties of clay on page 99. Other sections are devoted to rock salt and various other salines, to gypsum, fertilizers, abrasives, and several minor minerals. The last include glass sand, graphite, and lithographic stone. Regarding this stone the opinion is expressed that native quarries, well developed and well managed, are capable of furnishing the limited supply needed in America, as apart from the product of the celebrated Solenhofen quarries of Germany. Zinc and aluminum plates have been substituted for some uses, thus reducing the demand for lithographic stone.

Chapters deal with mineral and underground waters, and, very properly, with soils, certainly the most important of all materials with which economic geology has to do.

Not quite half the volume is reserved for the metallic minerals. This part begins with a chapter on ore deposits, in which theories of origin and modes of occurrence are discussed in a way not unduly technical. Iron is given first place when the specific account of metallic minerals is undertaken. Favourable location, high quality, considerable quantity, and structure permitting easy extraction are the four conditions assigned for the present predominance of Lake Superior ores.

The great preponderance of hematite among iron ores in this country is shown in the fact that for 1903 this type afforded 86.6 per cent. of the total production. The two leading producing regions at present are the Lake Superior district and the area about Birmingham, Alabama. The opinion of Van Hise is quoted, that the Lake Superior ores may be exhausted in the first half of the present century. The same authority looks forward to the marketing, in the near future, of ores running below 40 per cent. in iron. No other producing district in the world rivals the Superior region, which now affords at least three-fourths of the iron ore used in the United States. The current forming of limonite, or bog ore, is strikingly evidenced in the deposition, in Swedish ponds, of depths of 18 inches of this ore in periods varying from fifteen to thirty years.

It may surprise most readers to learn that the native copper of Michigan, as now mined, is contained in ores rarely running above 1 per cent. of native copper. Ninety per cent. of the copper of the United States comes from the States of Montana, Michigan, and Arizona, in the order named. Butte, in Montana, is the greatest producer in the world, the Anaconda mines alone yielding one-seventh of the world's supply. Butte began in 1887 to produce in excess of Lake Superior.

Fifty pages are devoted to gold and silver, including the silver-lead ores. Under aluminum, the bauxite localities are described, three in number: Georgia-Alabama, Arkansas, and New Mexico. The first was discovered in 1887, and the deposits have been worked since that time.

The book should be useful to a variety of readers, not only to students of economic geology, but to teachers of general geology and geography, and to all who are interested in the earth materials commonly used by man.

A. P. B.

The Geology of South Africa. By F. H. Hatch and G. S. Corstorphine. xiv and 348 pp. Macmillan & Co., London, 1905. (Price, $5.25.)

A related work, dealing with the geology of Cape Colony, was noticed by the present reviewer in the BULLETIN for December, 1905, page 753. The volume now noticed is of wider scope, but resembles the earlier work in being a summary account derived from many sources. Of the authors, Mr. Hatch has had wide connection with surveys in the British Empire, and Mr. Corstorphine was formerly Director of the Geological Survey of Cape Colony.

The beginnings of systematic South African geology are attributed to Andrew Geddes Bain, who died in 1864. The introductory chapter treats historically the growth of knowledge of that great region. The Transvaal began a survey in 1897 and Natal in 1898. The work suffered serious interruption in the years 1899-1903, the period of the war. The volume is adequately illustrated with sections, views, cuts of fossils, and maps. There is a folding map showing the geology of South Africa as a whole on the scale 78.88 miles=1 inch. There is also a large folding map of the formations of the Transvaal on the scale 19.7 miles=1 inch.

We find here what the work on Cape Colony lacks—namely, clear reference of the local formation names to the designations used in the world-wide nomenclature of historical geology. Thus opposite page 33 is a folding tabular view giving the European equivalents, with successive parallel columns giving the formation names in Southern Cape Colony, Northern Cape Colony, Orange River Colony, Natal, Rhodesia, and the Transvaal. An extended bibliography is included, also an index of place-names and a general index.

The evidence of glaciation in Carboniferous times (*Devyka Conglomerate*) is given, but perhaps with less fulness than in the volume on Cape Colony. The same conclusions are ,however, fully accepted. The chapter on diamond-bearing deposits, following many sections of local geological descriptions, will, perhaps, have the most interest to the general reader. The diamonds are found in a serpentinous breccia, occurring in "pipes" which, with a more or less vertical altitude, penetrate the stratified rocks, whereas these gems are in many regions found in alluvial or washed beds.

The breccia is of volcanic origin, having been forced up through the sedimentary strata. The pipes contain many fragments of these inclosing bed-rocks which have been torn away in the violent ascent. The diamonds occur in many crystal combinations, and with a wide range of size. A remarkably large specimen, known as the Cullinan stone, found in January, 1905, near Pretoria, has a weight of 3,024¾ carats, equivalent to 1.37 lbs. avoirdupois. Some of the volcanic pipes, while resembling the rest in all other respects, yield no diamonds.

The first stone found was picked up on the bank of the Orange River in 1867 by a Dutch farmer. It was exhibited at the Paris Exposition, and ultimately purchased by the Governor of Cape Colony for the sum of $2,500. The surface area of the Kimberley mine comprises nearly 10½ acres, including 470 claims. In January, 1904, the main shaft had been sunk to a depth of 2,599 feet. Descriptions are given of the mines of Cape Colony, Orange River Colony, and the Transvaal.

As to the origin of the pipes, the authors favour the view that they are due to volcanic explosions, with abundant steam, accounting thus for the mud-like character of the mass. As to the origin of the gems themselves there seems to be much confusion of opinion. A. P. B.

First Report on the Relations between Climates and Crops. By Cleveland Abbe. U. S. Department of Agriculture, Weather Bureau. Bulletin No. 36. 8vo. Washington, D. C., 1905. Pp. 376. (Price, $1.50.)

There is always a very active interest on the part of the large portion of every community in the relations between climate and weather on the one hand and the yield and character of the crop on the other. This interest is not confined solely to farmers and meteorologists; it extends to that larger body of persons who are directly or indirectly affected by the harvest. Professor Cleveland Abbe, some years ago made a thorough and careful compilation and summary of the best published results on the whole subject of the relations of climate and crops up to the year 1891. This report, officially known as "No. 5119, Sig. 91," was ready for publication at that time, but for various reasons it could not then be printed. Having had the opportunity ourselves to look over Professor Abbe's paper some years ago, and having realized its importance from many points of view, we have been hoping for publication these past ten years. It is a pleasure to record the appearance of this report in print, as *Bulletin* No. 36 of the Weather Bureau. The words *First Report* at the beginning of the title are a pleasing indication that in time we may have a second report, bringing the subject up to date.

Professor Abbe's intention in the preparation of his summary was to notice only those investigations that have given precise information as to specific plants or crops and specific localities; he has made a thorough search of all the more important literature, in so far as accessible to him, and the result is a useful handbook of reference for agriculturists, teachers of botany and climatology, and investigators along various lines of agricultural and botanical research. The agricultural colleges and agricultural experiment stations were especially in the mind of the author in the preparation of this volume. At the present time, when our Department of Agriculture is devoting so much attention to the introduction of new plants which shall be better adapted to climatic conditions in different parts of our country than those previously cultivated, this book will be of special interest to the scientific farmers of the United States. Professor Abbe's immediate purpose is stated by him in his preface in the following words:

> As far as practicable, I have presented, in the words of the respective authors, the results of their own investigations on the points at issue, my own duty being not to undertake any extensive original study, but to merely connect their results together in a logical manner, to collect data for future general use, and to suggest or stimulate further inquiry on the points here presented.

The volume is very valuable in giving first-hand information, on the various aspects of the subjects with which it deals, in a compact form, easily accessible, well arranged, and fully indexed. The work is divided into four parts. Part I concerns *Laboratory Work, Physiological and Experimental.* Part II deals with *Open-Air-Work—Experience in Natural Climates.* In Part III, *Statistical Farm Work,* the crops and climates of the United States are considered. Part IV contains the bibliography and index. It is obvious that such a report as this will prove widely useful, and it is our hope that Professor Abbe will soon be able to prepare, and the Weather Bureau be able to publish, an extension of the work up to date.

R. DeC. W.

Der Rhein und sein Verkehr, mit besonderer Berücksichtigung der Abhängigkeit von den natürlichen Verhältnissen. Von Dr. Friedrich Wickert, in Wiesbaden, 148 pp., 2 maps, 29 diagrams. Stuttgart, J. Engelhorn, 1903.

Based upon very thorough search among German official and other literature on the great water-artery of central Europe, this book upon the Rhine and its relations to transit, trade, and industry is certainly a most deserving achievement. Necessarily, it is a compilation; but this conveys no reproach. Data, and data as copious and exact as those furnished by Dr. Wickert, can only be obtained from an abundance of documents. Fortunately, German literature on the subject is exceedingly full of information, and, still more fortunately, the author is most competent to make use of it. Clear and concise in his statements, moderate in his deductions and conclusions, he places before the student a wealth of material of the most positive sort, and never indulges in side-flings at extra-German countries and doings, such as often make German literature since the "great rise" of Germany in 1870-1871 so uselessly obnoxious. His language is plain and matter-of-fact, nothing more nor less.

His descriptions of the Rhine from the sources in southeastern Switzerland to the frontier of Holland could hardly be more exact. The allusions in it to the origins and movements of drift are well put and characteristic. With rivers of an alpine origin, two factors must be carefully considered. One, the amount and kind of drift they carry; the other, the periodical perturbances created by the frozen sources of water-supply. This is very well accentuated in the description of the course of the Rhine as long as it remains under the direct influence of its alpine cradle. The rôle played by the Lake of Constance as a receptacle of drift carried by the river while yet in the state of a turbulent mountain stream, and of a clearing basin for the waters which emerge from it, leaving behind the detritus, is stated in few but expressive words.

Naturally, the main topics of the book—transit, trade, and industry, as affecting the Rhine and affected by it—become prominent only when the author has led his subject to where it becomes exclusively a German river. Previously only the northern bank of the Rhine, after leaving the Lake of Constance, is German, and through the affluence of Swiss branches of a partly alpine character and the geological features, to which Dr. Wickert is careful to refer, it is available only for rather primitive navigation, now largely superseded by railroads. The river becomes an important commercial highway only when it begins to flow between German banks. Dr. Wickert does not touch upon Holland. He might have done well, also, not to mention Swiss sections in a manner leading unsophisticated readers to suppose they might be parts of the German Empire of modern construction. The Canton of Graubünden, for instance, owes allegiance to Germany as little as any other part of Switzerland.

Very minute details, not only regarding the Rhine itself, but every one of its affluents on German soil, and taken from the most authoritative sources, constitute the bulk of Dr. Wickert's work. They are arranged geographically from south to north, and a wealth of tables, diagrams, and (at the end) highly-instructive maps, accompany them. The intention is to show the course of each tributary, the nature and resources of the countries traversed, the fluctuations of the water-courses produced by meteorological phenomena, and the influence they have had on transit, commerce, and industry, from former days (as far as data are accessible) to the present time. The author remains always true to his subject, not exceeding the limits that subject traces for him, but encompassing every thing that may be legitimately included. The historic side is treated in its proper place and in a concise manner. The flaws which have been pointed out do not affect the general excellence of the work. It is a book for study and reference, and a valuable contribution to hydrography and economic geography.

A. F. B.

Le Tour du Montblanc. Par Emile Daullia. viii–308 pp. Paris, Charles Mendel, 1899.

In this beautifully-illustrated volume the author is pursued too closely by recollections of *Tartarin sur les Alpes*. It is always difficult to imitate a genius like Alphonse Daudet, and when an attempt of the kind is to be harmonized with another "attempt" at serious description the outcome is usually a failure. Had Mr. Daullia confined himself to the rich material for description and information which his subject affords, and not tried to enliven his pages through too much "personal element," he would have produced a very readable book. As it is, there is not enough of the serious and there is too much of what *might* be entertaining, were it more vigorous. It appears that he sincerely enjoyed his "round-up" of the culminating point of Europe's highest mountains, that he felt the beauties of a scenery unparallelled, perhaps, anywhere; but the descriptions, however well written, are too much intersected by would-be humouristics of the mildest, most guileless, type.

The book is not altogether devoid of information, but it is, in the main, a kind of *feuilleton* rather than a piece of geographic literature. A great deal might have been said about the places described that would have been of lasting value. Dr. Daullia, however, sacrifices too much to the doubtfully witty. Whenever information is proffered it is not always correct. Thus the name of the celebrated St. Bernard dog, the mortal remains of which are preserved at the Museum of Berne, was not "Baril" but "Barry." Otherwise, the details given concerning these "Salvation" dogs are quite true.

No map accompanies this essay on the surroundings of Mont Blanc. The excellence of the photographic views compensates in part for the deficiency. The place of the book is with light literature of the semi-serious kind. A. F. B.

Die Eisenbahnen, ihre Entstehung und gegenwärtige Verbreitung. Von F. Hahn. 150 pp., Illustrations and Index. B. G. Teubner, Leipzig, 1905. (Price, M. 1.25.)

This interesting as well as edifying narrative treats of the origin, progress, and present distribution of railroads. It describes (1) pioneer railroad-building in England, Germany, and America; (2) railroad construction, rolling stock, signals, and other appliances so far as it is the purpose of the book to enter into the technical phases of the railroad business; (3) the great north and south roads, the great east and west roads, and the European mountain and city lines. The book is very readable, and at the same time full of information.

In the West Indies. By W. B. F. 64 pp. and 6 Illustrations from original photographs. Arnold Fairbairns, London, 1905. (Price, 1s.)

Contains ten articles, first printed in a British newspaper, and relating to Jamaica, Porto Rico, St. Thomas, the Boiling Lake of Dominica, cacao in Dominica, and Martinique. The book is well written, and gives a good idea of some of the islands from the tourist's standpoint. The author was very favourably impressed with the progress of Porto Rico (this is the official U. S. spelling, though the author uses the Spanish form). He says:

> It is not too much to say that, from a place of economic insignificance, the American will raise Puerto Rico to an island of the first importance in the West Indies, and this result may be looked for in a very little while.

Géographie agricole de la France et du Monde. Par J. Du Plessis de Grenédan. With 118 maps and diagrams. Paris, Masson et Cie., 1905. (Price, 7 fr.)

The object of this book is to place at the disposal of the students, in a clear and concise form, a sum of information on geographic-agricultural matters which could not be otherwise acquired except by laborious researches all over the field of general geography, and this purpose has been admirably attained. The author has selected, from physical, political, and economical geography, all that is of importance for the study of agriculture: the influences of soil, elevation, climate, geological structure of a given region on its production, the distribution of various forms of cultivation and production according to geographic conditions, and the ways and means by which, in each case, these conditions can be utilized to best advantage. The book is thus theoretical and practical at the same time, and the scientific spirit which pervades either part of the discussion makes it especially valuable among other books of this kind.

In the geographic conditionality of agriculture the author distinguishes between "natural" and "artificial" conditions. The former are the strictly geographic influences; the latter those created by the intervention of human activity—drainage, irrigation and other improvements, agricultural machines, population, transportation, opportunities for industrial utilization of agricultural products, and the like. These two chapters, preceded by a systematic introduction on the principal physiographic features of the country and supplemented by two short ones on the distribution of the different cultures and the national wealth represented in them, constitute the "general agricultural geography." They are followed by the "special agricultural geography," which deals with each culture in a separate chapter, discussing its conditions and possibilities.

This general and special treatment of France forms the first, and by far the largest, part of the book. The second part deals with the French colonies in accordance with the same scheme, and the third, likewise, with the agricultural countries of the world. The author sums up his results in a conclusion from a comparative point of view. According to him, the agricultural situation of the present is characterized by the contrast between the powers of large and small territories, whose conditions and prospects for the future differ materially from each other. Among the large territories Russia stands first in size. Even after deducting her share of forest, tundra, and desert, there are 600 million hectares of arable land in her possession, a large proportion of which is exceedingly fertile (the "black earth"). But there is no capital to develop these lands, and labour, though cheap, is handicapped by ignorance, laziness, and the comparatively thin population of this enormous area. These obstacles may be overcome in the course of time, but there will always be the two drawbacks of the uneven continental climate and the scarcity and remoteness of seaports.

Next in size follow the United States. They have less arable land than Russia, and no part of it can compare in quality with the black earth; but the climate is more favourable because less uniform: temperate in the East, continental in the centre, oceanic in the West, subtropical in the South. The population is numerous, and constantly increasing by a strong immigration. Capital abounds. Labour, while more expensive than in the Old World, is also better skilled, and avails itself of high-grade machinery, which counterbalances the difference in wages. An unparalleled location between the two largest oceans, a perfect organization of enterprise, and the general spirit of progress of the nation warrant the brightest prospects for the future.

China, the third in size, has 400 million hectares of fertile alluvial soil, among which is the unrivalled loess. The climate is varied, like that of the United States; labour is abundant, cheap, and intelligent. But the lack of machinery makes it comparatively more expensive, and the political and social conditions retard development.

Brazil comes next, with as much arable land as China and beautiful forests besides. A favourable climate and the excellent quality of the soil may one day enable her to compete with the United States, but the scarcity of population puts this day off to a rather distant future.

Australia's greatest disadvantage is her remoteness from the rest of the civilized world; wool and meat will always be the stand-bys of her farming industries.

East Africa repeats the Australian conditions on a smaller scale.

Argentina, while not quite so large, has comparatively better chances, her soil being very fertile and her climate favourable for white immigrants.

Canada, rich in fertile lands and forests, suffers from lack of hands to exploit her resources.

India has her most fertile regions in the very parts where the climate is unfit for whites, and indigenous labour is slow and unreliable. She may, however, increase her production beyond the present status.

In comparison with these large countries all others are only second-class Powers. The first group of them is formed by the countries of western and central Europe, whose place in the world-market is due mainly to the intensity of cultivation practised in countries of an old civilization. While at present France is behind Germany in the industrial race, the author is confident that as soon as she wakes up to a full consciousness of her natural resources, which are considerably superior to those of her rival, she will outstrip the latter just as the latter has outstripped Great Britain.

Another group comprises the extra-European countries of second-class size, such as Japan, Chile, Mexico, the Andean republics, Western Asia, Turkey, and also Greece. None of them seems so far to give promise of ever playing a rôle on the world-markets. All they can do is to satisfy the needs of home consumption.

To a third group belong the tropical countries of Africa. Their destination is to furnish colonies to the civilized nations as long as the regeneration of the black race, upon which an independent development of these countries will finally depend, is as yet a matter of a very distant future.

The book is very well written, and the illustrations and map sketches add greatly to its usefulness. M. K. G.

OBITUARY.

Israel Cook Russell.—Professor Russell, head of the Department of Geology in the University of Michigan, died on May 1. He was attacked by pneumonia, and his illness was brief. He was born in Garrattsville, N. Y., in 1852, studied at New York and Columbia Universities, was for a short time assistant Professor of Geology at Columbia, and became Geologist in the U. S. Geological Survey in 1880. He retained this position, though he subsequently became Professor of Geology in the University of Michigan. He wrote many scientific papers and a number of books, and was one of the most prominent and productive geologists and geographers of the country. He was vice-president of the American Association in 1904, and at the time of his death was President of the American Geological Association and a member of the Council of the Association of American Geographers.

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THE CLASSIFICATION OF CLIMATES: I.*

BY

ROBERT DeC. WARD,

Harvard University.

SYNOPSIS.

Need of a Classification of Climates.—Relation of Continental and Ocean Areas to Temperature: reasons for the slow change in the temperature of ocean waters.—Marine or Oceanic Climate.—Continental Climate.—Desert Climate.—Coast or Littoral Climate.—Monsoon Climate.—Mountain and Plateau Climate.—Mountains as Climatic Divides.

Need of a Classification of Climates.—A broad division of the earth's surface into zones is necessary as a first step in any systematic study of climate, but it is not satisfactory when a more detailed discussion is undertaken. The reaction of the physical features of the earth's surface upon the atmosphere complicates the climatic conditions found in each of the zones, and makes further subdivision desirable. Under the control of these different physical conditions the climatic elements unite to produce certain fairly distinct types of climate, and these may be classified in various ways. The usual method is to separate the *continental* (near sea-level) and the *marine*. An extreme variety of the continental is the *desert;* a modified form, the *littoral;* while altitude is so important a control that *mountain* and *plateau* climates are further grouped by themselves.

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* It is the object of this article to give a brief summary of the general climatic types which result from the control of land and water, and of altitude, over the more important elements of climate.

The following references have been consulted, in addition to those given in later foot-notes:

W. M. Davis: Elementary Meteorology, Boston, 1894, 335–344.

J. Hann: Handbook of Climatology. Translated by R. DeC. Ward. London and New York, 1903, 128–180, 222–374.

W. Köppen: Klimalehre, Leipzig, 1899, 93–104.

W. J. van Bebber: Hygienische Meteorologie, Stuttgart, 1895, 247–254.

Relation of Continental and Ocean Areas to Temperature.—Land and water differ greatly in their behaviour regarding absorption and radiation. The former warms and cools readily, and to a considerable degree; the latter, slowly and but little. (1) Of the insolation which falls upon the ocean a good deal is at once reflected, and is therefore not available for warming the water. Land surfaces, on the other hand, are poor reflectors; but little insolation is lost in that way; hence more energy is available for raising their temperature. (2) Most of the insolation which enters the water is transmitted to some depth, and, therefore, is not effectively applied to warming the surface. Land is opaque and does not allow the incident insolation to pass beyond a comparatively thin surface stratum; hence this surface can be well warmed. (3) The evaporation of water requires a large amount of energy, which changes the state of the water without raising its temperature (latent heat). Land, although often moist, is itself non-volatile; therefore the loss of energy in the process of evaporation is usually very slight. (4) Water is more difficult to warm than any other natural substance, while land is warmed easily and quickly. If equal amounts of heat are received by equal areas of land and water, the former warms about twice as much as the latter. (5) The mobility of water keeps the warmer and the colder portions well mixed, and therefore greatly retards the process of warming any one portion of the surface. Land cannot thus equalize its temperature. (6) The cloudiness over the oceans is usually greater than over the lands, and this operates to shade the former more than the latter, reducing the energy available for warming the water surface. For these various reasons, ocean surfaces can warm but little during the day, or in summer, and can cool but little during the night or in winter. They, and the air over them, are therefore conservative as regards their temperatures. Land areas, and the air over the lands, on the other hand, warm and cool readily.

Marine or Oceanic Climate.—Conservatism in its temperature conditions is the most distinctive feature of a marine climate. The results of the "Challenger" Expedition show that the diurnal range of air temperature over the ocean between latitudes 0° and 40° averages only 2° or 3°. Further, the slow changes in temperature of the ocean waters involve a retardation in the times of occurrence of the maxima and minima, and a marine climate, therefore, has characteristically a cold spring and a warm autumn, the seasonal changes of temperature being but slight. The surface waters of oceans and lakes average somewhat warmer than the air over them, and for this reason all considerable bodies of water which remain unfrozen in winter become sources of warmth for the adjacent lands during the colder months. Characteristic, also, of marine climates is a prevailingly higher relative humidity, a larger amount of cloudiness, and a heavier rainfall than is found over continental interiors. All of these features have their explanation in the abundant evaporation from the ocean surfaces. In the middle latitudes, again, there is this contrast between the oceans and the continental interiors, that the former have distinctly rainy winters, while over the latter the colder months have a minimum of precipitation. Ocean air is cleaner and purer than land air, and ocean air is, on the whole, in more active motion, because friction of air on water is less than friction of air on land.

It is obvious that an equable, damp, and cloudy climate such as that which is, on the whole, typical of the oceans and of their leeward coasts must affect vegetation in a way quite different from that noted in a hotter and drier climate, with greater variations of temperature. Thus Schindler* has shown that wheat contains less protein in a marine climate, and hence more meat, leguminous plants, and other nitrogenous foods are necessarily eaten. An interior climate, like that of Southern Russia and Hungary, produces wheat which is richer in protein: the need of other nitrogenous foods is consequently decreased. The proportion of starch is decreased, and that of gluten is increased, in a hot, dry climate. The size of the crop is also affected by the climate.

Continental Climate.—Marine climate is equable; continental is severe. The annual temperature ranges increase, as a whole, with increasing distance from the oceans;† the regular diurnal ranges are also large, reaching 35° or 40°, and even more, in the arid continental interiors. The warmest and coldest months are usually January and July, the times of maximum and minimum temperatures being less retarded than in the case of marine climates. April is usually warmer than October, unless spring warming is delayed by the melting of a snow-cover. In the latter case, the snow-covered land surface temporarily takes on the characteristics of a water surface, and has a retarded spring. The greater seasonal contrasts in temperature over the continents than over the oceans are furthered by the less cloudiness over the former. The clearer continental skies of high latitudes favour a lowering of the winter, but a slight rise of the summer temperatures, while in lower latitudes the clearer summer skies favour a higher mean annual temperature. Diurnal and annual changes of nearly all the elements of climate are greater over continents than over oceans; and this holds true of irregular as well as of regular variations. The contrast between marine and continental climates in the matter of the annual march of temperature is shown in the accompanying figure (Fig. 1). In low latitudes the curve for Funchal, on the island of Madeira (M), represents the marine type, and that for Bagdad, in Asia Minor (Bd), the continental. For higher latitudes, the curves for Valentia (V), a coast station in the southwest of Ireland, and for Nertschinsk (N), in eastern Siberia, are representatives of the two types.

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* F. Schindler: *Der Weizen in seinen Beziehungen zum Klima*, Berlin, 1893.

† See chart of equal annual ranges of temperature, Bartholomew's Atlas of Meteorology, Pl. 2.

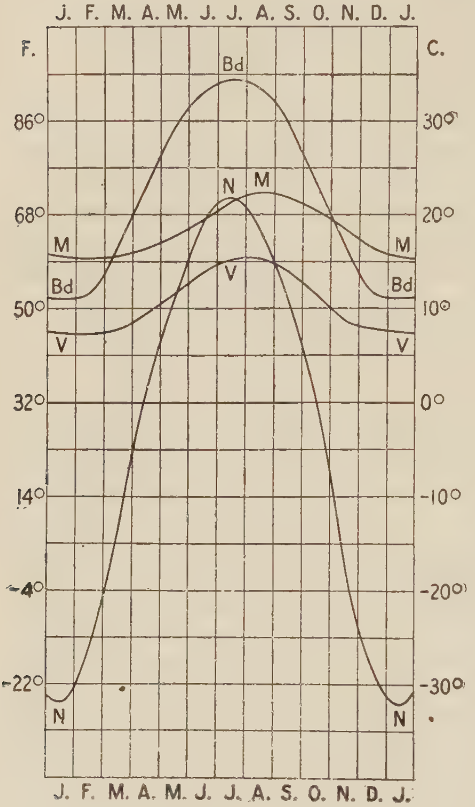

FIG. 1 (AFTER ANGOT).
ANNUAL VARIATION OF TEMPERATURE.

Owing to the distance from the chief source of supply of water-vapour—the oceans—the air over the larger land areas is naturally drier and dustier than that over the oceans. Yet even in the arid continental interiors in summer the absolute vapour content is surprisingly large, although the air is still far from being saturated. In the hottest months the percentages of relative humidity may reach 20% or 30%. At the low temperatures which prevail in the winter of the higher latitudes the absolute humidity is very low, but, owing to the cold, the air is often damp. Cloudiness, as a rule, decreases inland, reaching its minimum in deserts. And with this lower relative humidity, more abundant sunshine and higher temperature, the evaporating power of a continental climate is much greater than that of the more humid, cloudier, and cooler marine climate. Actual evaporation is, however, under these conditions, usually much less than the possible evaporation which would take place were there enough water present to be evaporated. Both amount and frequency of rainfall, as a rule, decrease inland, but the conditions are very largely controlled by local topography and by the prevailing winds. The decreased frequency of rainfall on the lowlands is especially marked in winter. Winds average somewhat lower in velocity, and calms are more frequent, over continents than over oceans. The seasonal changes of pressure over the former give rise to systems of inflowing and outflowing, so-called continental, winds, sometimes so well developed as to become true monsoons. Usually, however, the changes in direction and the development are not very marked.

In winter, clear, crisp days, followed by cold, calm nights, and interrupted from time to time by spells of cloudy, windy weather, with or without light precipitation; in summer, clear, calm nights, followed by hot days with increasing wind velocity and heavy clouds towards noon, and often by thunderstorms in the later afternoon. These are typical weather conditions of continental interiors in the higher latitudes; and they are of much interest to man. The extreme temperature changes which occur over the continents are the more easily borne because of the dryness of the air; because the minimum temperatures of winter occur when there is little or no wind, and because during the warmer hours of the summer there is the most air movement.

Desert Climate.—An extreme type of continental climate may be found in deserts. It is a curious fact that desert and marine climates—the two extremes of the climatic scale—resemble one another in some respects. Desert air, albeit often dusty by day, is notably free from micro-organisms; the purity of ocean air is well known. Again, deserts and oceans alike have high wind velocities. The large diurnal temperature ranges of inland regions, which are most marked where there is little or no vegetation, give rise to active convectional currents during the warmer hours of the day. Hence high winds, disagreeable because of the dust and sand which they carry, are common by day, while the nights are apt to be calm and relatively cool. Travelling by day is unpleasant under such conditions. Diurnal cumulus clouds, often absent because of the excessive dryness of the air, are thus replaced by clouds of blowing dust and sand. This sand, often carried afar, may find a resting-place on the moister lands to leeward. Thus beds of loess are formed. Indeed, many geological phenomena, and special physiographic types of varied kinds, are associated with the peculiar conditions of desert climate.* The excessive diurnal ranges of temperature cause rocks to split and break up. Wind-driven sand erodes and polishes the rocks. When the separate fragments become small enough they, in their turn, are transported by the winds and further eroded by friction during their journey. The ground is often swept clean by the winds. Curious conditions of drainage result from the deficiency in rainfall. Rivers "wither" away, or end in sinks or brackish lakes. Desert plants protect themselves against the attacks of animals by means of thorns, and against evaporation by means of hard surfaces and an absence of leaves. The life of man in the desert is likewise strikingly controlled by the climatic peculiarities of strong sunshine, of heat and of dust.

Coast or Littoral Climate.—Between the pure marine and the pure continental types the coasts furnish almost every grade of transition. Hence coast or littoral climates may well be placed in a group by themselves. Prevailing winds are here important controls. When these blow from the ocean, as on the western coasts of the temperate zones, the climates are more marine in character; but when they are offshore, as on the eastern coasts of these same zones, a somewhat modified type of continental climate prevails, even up to the immediate sea-coast. Hence the former have a much smaller range of temperature; their summers are more moderate and their winters milder; extreme temperatures are very rare; the air is damp; there is much cloud. All these marine features diminish with increasing distance from the ocean especially when there are mountain ranges near the coast, as is the case in the western United States and in Scandinavia. In the tropics, windward coasts are usually well supplied with rainfall, and the temperatures are modified by sea breezes. Leeward coasts in the trade-wind belts offer special conditions. Here the deserts often reach the sea, as on the western coasts of South America, Africa, and Australia. Cold ocean currents, with prevailing winds along rather than on-shore, are here hostile to rainfall, although the lower air is often damp, and fog and cloud are not uncommon.

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* See, for example, W. M. Davis: Physical Geography, Boston, 1899, 297–324.

Monsoon Climate.—Exceptions to the general rule of rainier eastern coasts in trade-wind latitudes are found in the monsoon regions, as in India, for example, where the western coast of the peninsula is abundantly watered by the wet southwest monsoon. As monsoons often sweep over large districts, not only coast but interior, a separate group of monsoon climates is desirable. In India there are really three seasons—one cold, during the winter monsoon; one hot, in the transition season; and one wet, during the summer monsoon. Little precipitation occurs in winter, and that chiefly in the northern provinces. The high temperatures of the transition periods are most oppressive when the air is most damp. In India this is the case in the autumn. In low latitudes, monsoon and non-monsoon climates differ but little, for summer monsoons and regular trade winds both give rains, and wind direction has slight effect upon temperature.

The winter monsoon is offshore and the summer monsoon onshore under typical conditions, as in India. But exceptional cases are found where the opposite is true. Thus, on the northwestern coast of Japan, the northeastern coasts of Formosa and of the Philippines, and the eastern coasts of the southern Deccan and of Ceylon, the prevailing offshore winter dry monsoon becomes an onshore rainy wind. Many complicated cases of this kind are not easily co-ordinated. In higher latitudes the seasonal changes of the winds, although not truly monsoonal, involve differences in temperature and in other climatic elements. The eastern coast of the United States has prevailing cold, dry, clear winds from the continental interior in winter, while the prevailing winds of summer are southwest, and hence warm and often moist. The only well-developed monsoons on the coast of the continents of higher latitudes are those of eastern Asia. These are offshore during the winter, giving dry, clear, and cold weather; while the onshore movement in summer gives cool, damp, and cloudy weather. Without these seasonal winds the winters would have the maximum amount of rain and cloud.

Mountain and Plateau Climate.—Both by reason of their actual height and because of their obstructive effects, mountains influence climate similarly in all the zones. Hence mountain and plateau climates are placed in a group by themselves, as distinguished from those of lowlands. The former, as contrasted with the latter, are characterized by a decrease in pressure, temperature, and absolute humidity; an increased intensity of insolation and radiation; larger ranges in soil temperature; usually a greater frequency of, and up to a certain altitude more, precipitation.

At an altitude of 16,000 ft., more or less, pressure is reduced to about one-half of its sea-level value. The highest human habitations are found under these conditions. While the pressures and the pressure changes at sea-level have no marked effect upon man, the physiological effects of the decreased pressure aloft (faintness, nausea, headache, weakness) are experienced by a majority of people at altitudes above 12,000 to 15,000 ft. The symptoms, and the height at which they appear, vary much in different cases, and depend upon the physical condition, the weather, bodily exertion, and so on. The greatest altitudes attained by man were reached by balloon, and in such cases a supply of oxygen is usually taken up by the aeronaut. Man endures the rapid pressure changes during balloon ascents with difficulty, and often only with considerable suffering. The eagle and the condor, however, suffer no inconvenience during their high flights.

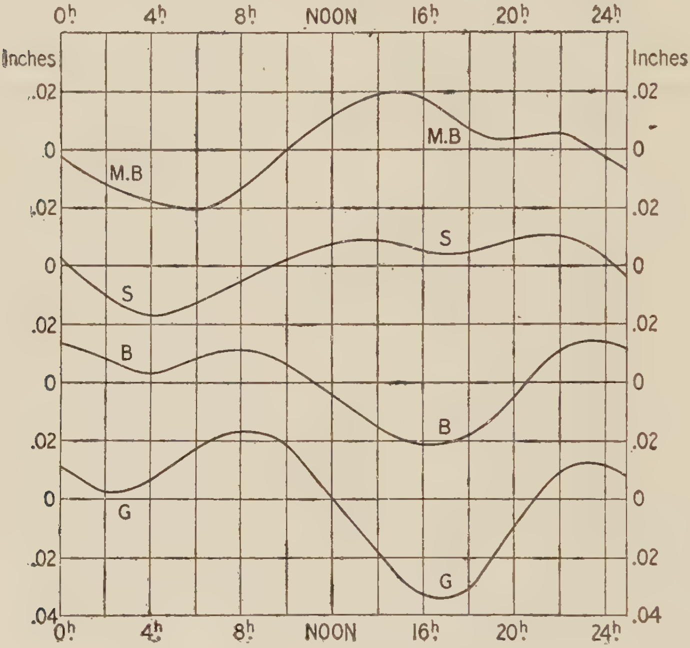


FIG. 2 (AFTER ANGOT).
DIURNAL VARIATION OF PRESSURE.

It has been suggested by Jourdanet that mountain and plateau climates be divided into groups, *climats de montagne*, below 6,500 feet, and *climats d'altitude*, above that height. The former are beneficial because of the stimulating quality of their clean, cool air; the latter may be injurious because of the low pressure. The variations in pressure, as well as the actual pressures, diminish aloft. On high mountains and plateaux the pressure is lower in winter than in summer, owing to the fact that the atmosphere is compressed to lower levels in the winter and is expanded upwards in summer. The morning minimum pressure on mountains is usually the primary minimum, the afternoon minimum being less marked and coming later than on lowlands. Figure 2 shows the diurnal variation of pressure at Geneva (408 meters, G), Berne (573 meters, B), on the Säntis (2,467 meters, S), and on the summit of Mont Blanc (4,811 meters, MB), and illustrates well the general characteristics of the curves found at different altitudes. Local topography, however, is an important controlling influence, and modifies such curves very much.

The intensity of insolation and of radiation both increase aloft in the cleaner, purer, drier, and thinner air of mountain climates. The great intensity of the sun's rays attracts the attention of mountain-climbers at great altitudes. The excess of surface temperature over air temperature also increases aloft, and is a favourable element in plant growth. There is likewise an increase in the range of surface temperature, although this is much influenced by exposure. The vertical decrease of temperature, which is also much affected by local conditions, is especially rapid during the warmer months and hours; mountains are then cooler than lowlands. The inversions of temperature characteristic of the colder months, and of the night, give mountains the advantage of higher temperature then—a fact of importance in connection with the use of mountains as winter resorts. At such times the cold air flows down the mountain sides and collects in the valleys below, being replaced by warmer air aloft. Hence diurnal and annual ranges of temperature on the mountain tops of middle and higher latitudes are lessened, and the climate in this respect resembles a marine condition, but topography and the conditions of local clouds and winds are here important controls. The times of occurrence of the maximum and minimum are also much influenced by local conditions. Fig. 3 shows the diurnal march of temperature for Paris (solid) and the Eiffel Tower (broken) in January and July. It will be noted that the times of maximum and minimum are retarded on the Eiffel Tower, and that the range is less than at the earth's surface. These are characteristics of mountain climates. Elevated enclosed valleys, with strong sunshine, often resemble continental conditions of large temperature range, and plateaux, as compared with mountains at the same altitude, have relatively higher temperatures and larger temperature ranges. Altitude tempers the heat of the low latitudes. High mountain peaks, even on the equator, can remain snow-covered the year around; the plateau of southern India at 6,000 to 7,000 ft. above sea-level always has moderate mean temperatures, and from the dense jungle of the tropical lowland to the snowy mountain-top successive zones of vegetation are encountered.

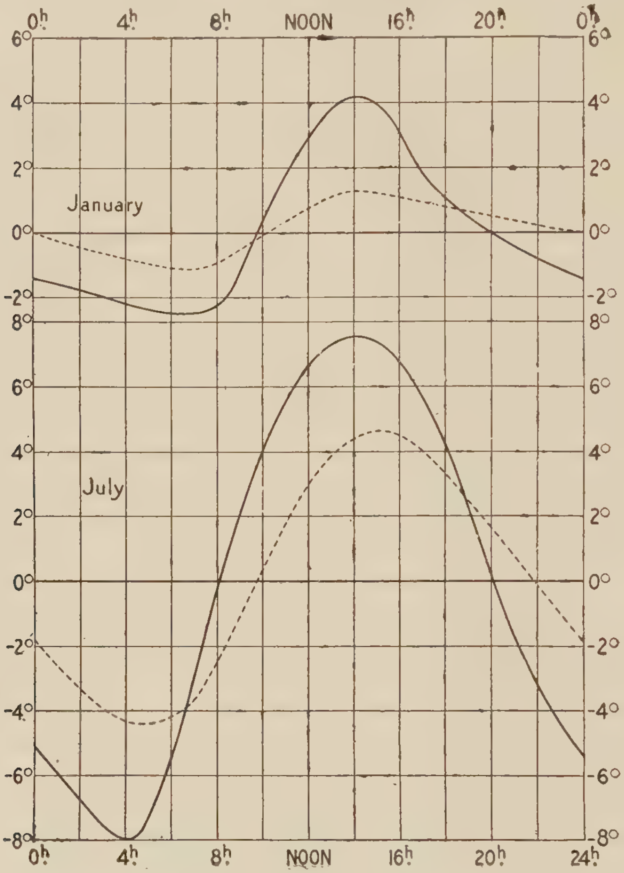


FIG. 3 (AFTER ANGOT).
INFLUENCE OF ALTITUDE ON THE DIURNAL VARIATION OF TEMPERATURE.

Nine-tenths of the water vapour in the atmosphere are below 21,000 feet. Hence mountains are important vapour barriers, and one side may be damp while the other is dry. Curiously mistaken ideas of distance often result from the remarkable clearness and dryness of the air on high mountains. No general law governs the variations of relative humidity with altitude, but on the mountains of Europe the winter is the driest season, and the summer the dampest. At well-exposed stations there is a rapid increase in the vapour content soon after noon, especially in summer. The same is true of cloudiness, which is often greater on mountains than at lower levels, and is usually at a maximum in summer, while the opposite is true of the lowlands in the temperate latitudes. One of the great advantages of the higher Alpine valleys in winter is their small amount of cloud. This, combined with their low wind velocity and strong insolation, makes them desirable winter health resorts. Latitude, altitude, topography, and winds are determining factors in controlling the cloudiness on mountains. In intermediate latitudes there is a seasonal migration of the level of maximum cloudiness and of maximum relative humidity from the lowlands in winter to higher altitudes in the warmer months, in association with the diurnal convectional movements of the warmer season. Frequent rapid local changes also occur. In the rare, often dry, air of mountains and plateaux evaporation is rapid, the skin dries and cracks, and thirst is increased.

Rainfall usually increases with increasing altitude up to a certain point, beyond which, owing to the loss of water vapour, this increase stops. The zone of maximum rainfall averages about 6,000 to 7,000 feet in altitude, more or less, in intermediate latitudes, being lower in winter and higher in summer. Mountains usually have a rainy and a drier side; the contrast between the two is greatest when a prevailing damp wind crosses the mountain, or when one slope faces seaward and the other landward. When the prevailing winds differ little in dampness this contrast is lessened, and there may then be a very close correspondence between the rainfall and the topographic map of a region. Mountains often provoke rainfall, and local "islands," or, better, "lakes," of heavier precipitation result. Such are found on the mountains of the Sahara, and of other deserts. This local precipitation favours the growth of vegetation; small streams and oases are found, and temporary camps, or more permanent settlements, of the nomadic tribes of the desert, are there established. Well-marked zones of vegetation are noted under such conditions, as in the transition from the dry Californian lowlands up through the deciduous and then the coniferous forests of the Sierra Nevada to the snows on the summits. Similarly, the high plateaux of southern Utah and of Arizona are high enough to receive fairly abundant rainfall, while the lowlands are arid.

Mountains resemble marine climates in having higher wind velocities than continental lowlands; mountain summits have a nocturnal maximum of wind velocity, while plateaux usually have a diurnal maximum. Mountains both modify the general, and give rise to local, winds. Among the latter the well-known mountain and valley winds are often of considerable hygienic importance in their control of the diurnal period of humidity, cloudiness, and rainfall, the ascending wind of daytime tending to give clouds and rain aloft, while the opposite conditions prevail at night. The high temperature and dryness of the *foehn,* which is of immense benefit to man by reason of its melting and evaporating powers, although often enervating and depressing, result from the fact of a descent of the air from a mountain slope or summit. The bora, with its cold gusts, is a wind in whose development a mountain or plateau is essential. And the mistral of Southern France owes some of its cold to radiation over the interior plateaux.

Mountains as Climatic Divides.—Very different conditions of temperature, pressure, and humidity may be found on the opposite sides of a well-defined mountain range, because such a range interferes with the free horizontal interchange of the lower air. Mountain ranges which trend east and west, like the Alps and the Himalayas, separate more severe from less severe climates; those which follow a coast-line, as in the case of California, Scandinavia, or eastern Siberia, separate marine from continental. Large differences of pressure on the two sides may be equalized by a flow of air across the mountain, as in the foehn.

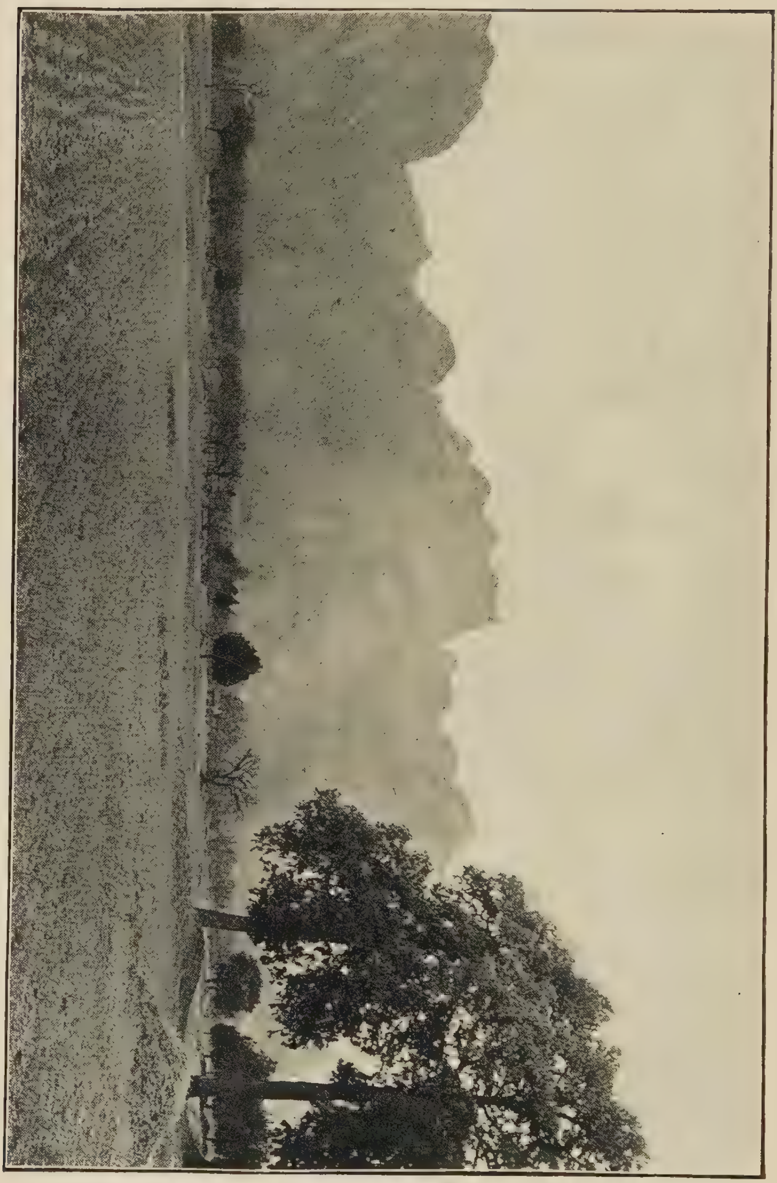
AMONG THE MOUNTAINS OF SHEN-SI.

BY

BAILEY WILLIS.

In the province of the Western Passes, Shen-si, among the outliers of the Tibetan Mountains, six hundred miles southwest of Peking, spreads a rich valley. The Wei River flows through it from west to east, and the Huang-ho, entering it from the north, turns sharply eastward and leaves it by a cañon which leads to the great plains. In extent this valley of the Wei is not unlike that of the Mohawk in northern New York, or that of the upper Danube in southern Germany. It is a wide and fertile plain, shut in among mountains, but through it pass the great highways of the continent, and it has been the scene of historic events, the centre of dynasties, for more than three thousand years. Southeast of this valley rises the Hua-shan, a granite range whose bold cliffs compare with those of the Yosemite. Their grandeur is enhanced by contrast with the level plain, the base from which they tower abruptly without intervening slopes. The Hua-shan is one of the five sacred mountains of China, and on its summit, four thousand feet above the plain, are monasteries, which are reached by means of irons and chains set in the rocks. Westward from its highest point the crest of the range declines, the face becomes less precipitous, and the ridge sinks at length beneath the valley plain. The traveller who rounds it sees to the south another great mountain chain, the Ts'in-ling-shan, which stretches westward as far as the eye can reach and ultimately merges in the High Plateaux of Central Asia. It has been called the Barrier Range of China; for, as the Alps divide Germany and Italy, so the Ts'in-ling-shan separates North China from South. Among the many more or less difficult paths by which it may be crossed by mountaineers there is but one pass which Nature has opened across it. Toward its eastern end, where it becomes tangent to the southern slope of the Hua-shan, only a low divide separates a tributary of the Wei River from the T'ang-ho, a tributary of the Han and the Yang-tze, and through this pass lies one of the great historic routes of migration and commerce, from the plains of southeastern China to central Asia and Europe. A second highway passes the eastern end of the Hua-shan. It is that which leads southwest from Peking, through Shan-si into the valley of the Wei, and which continues thence southwestward across the Ts'in-ling-shan to the rich province of Sze-chwan, the upper Yang-tze, and India. The passage of the barrier range is accomplished by a military road said to have been laid out by the Emperor Ts'in, the builder of the Great Wall, 255-206 B. C. In the later history of the rise and fall of Chinese dynasties it was long neglected and but partly rebuilt. Though it excited the astonishment of the Tyrolean Father Martini, in the middle of the seventeenth century, it had sunk in von Richthofen's day, 1880, to the condition of a wretched mule path, scarcely practicable for pack animals.

At the foot of the mountains where the roads meet from the Yang-tze, from Peking, from Tibet, and from India is a great commercial city, Si-ngan-fu. Its history is rooted in the myths of the earliest Chinese traditions. Eleven hundred years before Christ it



HUA-SHAN,

IN THE PROVINCE OF SHEN-SI. ONE OF THE FIVE SACRED MOUNTAINS OF CHINA, AS SEEN FROM THE VALLEY OF THE WEI.

was the capital of the Chou dynasty, and for many centuries it continued to be an imperial city. It was the most eastern point known to Ptolemy, the geographer, and by Marco Polo was described thus:

> And when you have travelled those eight days' journey, you come to that great city which I mentioned, called Kenjanfu. A very great and fine city it is, and the capitol of the kingdom of Kenjanfu, which, in the old times, was a noble, rich and powerful realm, and had many great and wealthy and puissant kings. But now the king thereof is a prince called Mangalai, the son of the Great Kaan, who hath given him this realm, and crowned him king thereof. It is a city of great trade and industry. They have great abundance of silk, from which they weave clothes of silk and gold of divers kinds, and they also manufacture all sorts of equipments for an army. They have every necessary of man's life very cheap. The city lies towards the west; the people are Idolators; and outside the city is the palace of the Prince Mangalai, crowned king, and son of the great Kaan, as I told you before.

In recent times the old city, long deserted by royalty, once more became the imperial residence. The Empress, when she fled from Peking, took up her abode there, ostensibly to do honour to the ancient emperors, but in fact to get as far as possible from the invading barbarians. To-day the city has returned to those pursuits of commerce which its geographic position naturally determines, and the people are happier than when the hordes of hangers-on of the Court devoured their substance and the price of food became exorbitant even in the fertile valley of the Wei. The road from Peking to Si-ngan-fu was prepared for the royal progress by grading away ruts and covering the surface with yellow earth; all traffic was suspended for two weeks, and the communities and carters suffered accordingly. One still heard mutterings against the Empress for having the people's interest so little at heart when, three years later, I followed the route of her flight.

The people along the road still cursed the Empress when I passed that way four years later. Coming from the direction of Peking, the historic highway crosses the Yellow River at the Tung-kuan, a fortress of strategic importance in the T'ai-ping rebellion and earlier wars, but now easily within reach of artillery from the high terrace north of the river. Thence it passes beneath the lofty crags of the Hua-shan and, a few miles from Si-ngan-fu, reaches the hot springs of Lin-tung. A journey of three weeks in Chinese carts, through the loess country of Shan-si, prepares the traveller for rest and the rare pleasure of a bath. The impalpable yellow dust of the roads through the loess penetrates every garment and the very pores of the skin, and one who has not experienced it can scarcely imagine the choking sensation with which you ride hour after hour in its yellow cloud. I had sent our Chinese boys ahead, and expected, on arriving at Lin-tung, to find comfortable quarters ready for our reception; but instead, our loaded carts stood outside the enclosure about the springs, and Li, our head boy, was engaged in angry altercation with the servants in charge of the Kung-kuan, the official hostelry. Stick in hand, the loyal but excitable fellow was ready to lay about him with a will, when I appeared. He was insulted in our behalf at the wretched pools in which they suggested we might bathe, and which were commonly used by coolies. I was angered, too; but firmness and dignity go farther in China than threats or blows, and by their use we soon opened the doors to the official apartments. There were airy reception-rooms looking out upon a pleasant court, and private rooms adjoining, in each of which was a deep square tank of stone filled with an overflowing current of hot water, 104° Fahr., into which a flight of steps led down. Close by were the garden, pavilion, and bath used by the Empress during her residence at Si-ngan-fu. The bushes were growing over the paths, and the buildings, stripped of their hangings and furniture, were desolate; but pacing the terrace before the Empress' private apartment, looking down upon the pretty pavilion on an island in the bubbling pool, or out across the walls to the expanse of plain and lofty mountains, one pondered what influences had wrought upon the remarkable woman who, returned to Peking, has reversed her whole course of action, and now welcomes the aliens from whom she once fled. Her course presents, in the full glare of publicity, a change of front such as the Chinese not infrequently execute when necessity commands—and execute, too, with a grace which converts the necessity into a voluntary purpose.

Si-ngan-fu is the residence of the Governor of Shen-si, and our reception was for us a matter of importance, as likely to indicate the attitude of that official toward the surveys we wished to prosecute. Passports and letters of introduction had preceded us, and we had every reason to expect that courtesy which had been extended to us elsewhere; but though we had travelled several days in the province, no message of greeting had come from the Governor, and his subordinates, the magistrates residing in the chief towns along the way, had no instructions concerning our party. On leaving Shan-si we had rewarded and dismissed the four faithful cavalrymen who, by order of the Governor of that province, had accompanied us three hundred miles on our journey, and we were now travelling unattended toward the city. The great road crosses a tributary of the Wei, on a fine stone bridge a quarter of a mile in length, and one sees the massive walls of the city, fifty feet high, with crenelated battlements and huge gate towers, rising from the higher plain. Along the highway outside the wall, for something more than two miles, stretches a densely-built suburb of shops and dwellings, many enterprising merchants having establishments outside the gate to avoid the city tax on produce and goods which pass in. We approached from the north, and rode in carts slowly through the busy throngs of the suburbs, along one of the two principal streets which cross at right angles in a central tower, a heavy structure with four arches covering the intersecting streets. There the congested traffic is forced into still narrower space, in which there is scarcely room for two carts to pass, and yet on either hand vendors of trifles and eatables establish their stands, and coolies, eating bowls of rice or soup, sit unmoved, though the long projecting axles graze their backs. Here one may see every grade of Chinese society, from the beggars who sit before shop doors picking vermin from their rags till paid to move on, to the high official who comes in his sedan chair, preceded by horsemen and footmen and the blare of trumpets. All outside official rank jostle elbows in the crowd—the labourer, the hawker of trifles, the banker, and the scholar. And the labourer's son, as well as the banker's or the scholar's, if he have ability and learn, may come to ride in his chair with banners and trumpets going before him.

There being no one to direct us to the quarters usually provided by official courtesy, we pressed through the moving throng to an inn, the only one available—a dark, noisome place reeking with filth. Our cards were sent to the Foreign Office, and then ensued an exchange of profound regrets—regrets on the part of the official whose duty it was to receive us that the city was so wretchedly poor there was no suitable place to entertain such distinguished visitors; regrets on my part that so eminent and learned a man as he must be should so disgrace himself by allowing strangers to remain in lodgings so unfit. After two days of courteous but unwavering insistence, we were recognized and were given decent accommodations. Interviews with the officials, military and civil, including the Governor, followed, and the obstacles which had threatened to stop our further explorations vanished. We found the Governor, if not progressive, intelligent and friendly; and let me say that he was justified, unfortunately, in receiving foreigners with suspicion. Some months before there had come one, a traveller from Europe through central Asia, whom we had to thank for our reception here as well as for that at the hot springs of Lin-tung. With vile language and brutal temper he had demanded everything, paid for nothing, and beaten the servants sent to attend him. True, he was an uncommon brute; but there are too many of his kind. The Chinese gentleman is not without reason in seeking to assure himself that the foreigner is not "ignorant of restraint."

From Si-ngan-fu our route lay southward across the Ts'in-ling-shan to the Han River. We did not wish to tread the well-known routes of the great highways; we asked about by-ways, and prepared to abandon the comfort of Chinese inns for tents in the wilderness. The many coolies required to carry food made a striking procession as they straggled out from Chou-ch'ih-hien, the town in which we assembled the outfit for our start. The day was showery, and the men went bare-legged, shod with grass sandals, their blue blouses tucked up and their huge umbrella-like hats tied under their chins. Spring had come in the valley of the Wei. Wheat and poppy fields were green, violets and lupine blossomed, the trees were opening their buds, and the scent of moist earth filled the air. Heavy clouds still hid the Ts'in-ling-shan after three weeks of rain, and the mountain streams were foaming torrents.

We could learn but little concerning the route ahead, and were warned not to attempt the mountain paths and fords; so, leaving my two American comrades and the coolie caravan to work their way slowly into the defiles of the northern front, I pressed ahead with Li and a single mountaineer, to reconnoitre. It is well said in China you cannot get out of sight of the Chinese; even in the Ts'in-ling-shan they inhabit every nook, and footpaths lead everywhere. Wild, rough trails they are, unfit for even donkeys; constantly crossing and recrossing the torrential streams, occasionally carried around a cliff along poles or boards, supported on rotting props stuck in the rocks. The mountain face rises abruptly, the cañons are deep and narrow from their mouths inwards, and soon the steep and jagged spurs shut out all view but the rocks, the foliage, and the clear, brawling river. Along the footpath is here and there a hut, and one meets the poorest of the poor carrying out heavy loads of coffin boards. Sawed out where the tree grows, these are about three inches thick, eight feet long, and a foot to eighteen inches wide. Four of them, slung on a man's back so that one end rests on the ground when he stands upright, but is raised from it as he bends forward, make a staggering load. Steadying himself by two poles shod with iron the bearer crawls slowly along the dangerous path. Glancing up as they met me, these men looked dumb amazement; they were too slow to catch a passing remark, but where I stopped among them they were quiet and obliging. Sometimes I slept outside their huts, in the shelter of a boulder or cliff. One night I was housed in an inn which they frequented. There was a big room, where the kang, the clay sleeping platform, was heated for all comers to share; the one great cast-iron bowl served to boil whatever any one brought, and the smoke, steam, and human reek were breathed by all alike. I stayed in it long enough to get a distinct impression of the Devil's reception-room in Hades, and was glad of a corner in a storeroom, which Li had found and made comfortable.

The first foreigner to tread that trail, I was an object of intense curiosity; but I was not annoyed. Children came to stare and stayed to be amused; the older ones of the family passed through oftener, perhaps, than their avocations required, but the vulgar impertinence of village crowds was not apparent. The innkeeper's wife came and went about her business. She was shabbily dressed, but wore silver earrings, two finger rings, and a bracelet. From the bag of flour she weighed out portions with a steelyard and basket that she balanced accurately. All food is carried in, and flour costs fifty cash a catty, as against twenty-eight in the plains below. The villagers are woodcutters; they drive logs on the stream with spiked poles, much as we do, but their logs are rarely more than a foot through and eight feet long. There are two distinct ethnological types among these people. The one is of pale yellow complexion, with well-developed nose and straight eyes; the cheek-bones are high and the jaws slender. It is a type we see in north China, where the slanting almond eye of the southern Chinese is not the rule. The other face is very broad and flat, the eyes set in long straight slits and far apart; where the bridge of the nose should be is a hollow, and the wide nostrils expand under a turned-up tip of a nose. The mouth is very large, the expression dull but very good-natured. Both men and women are remarkably short, but very broad and strong. I took the latter type to be survivors of an aboriginal race, or remnants of a distinct immigration, which elsewhere has been absorbed by the dominant Chinese.

After several days' absence, I returned from the summit of the Ts'in-ling-shan to my comrades, who had made their way up the cañon of the Hei-shui-ho. The reconnoissance having made it evident that we must carry more food and be prepared for greater delays than we had anticipated, Li was sent out with fifteen coolies to bring in rice. Before he could return the Hei-shui-ho was swollen by continuous rains to a flood which cut us off in all directions, so we prepared to wait as patiently as we might for Li's return, and were astonished when he appeared early one morning with his heavily-loaded men. After trying the fords and finding them impassable, he had built a raft; and having put the rice upon it, he and the coolies had swum the river, pushing it before them. They thus reached a dangerous track, which had once been a pathway on the eastern bank but was washed out and abandoned, and along this they made their way to us.

From our camp on the Hei-shui-ho the path led up from the cañon to gently-moulded spurs of the still higher mountain summits, presenting a contrast such as may be seen in North Carolina, in Norway, and many other mountain districts where an old hill country has been rapidly uplifted to mountainous altitude and sharply and deeply cut by the rivers. The heights had once been timbered; and though the climate above 5,000 feet is severe, they had been to some extent cultivated while lumbering flourished. Then our route was frequented by merchants, and the inns did a profitable business; but in those days life was not any too secure in these remote fastnesses. If a lonely traveller was seen to have money, he was made away with at one inn or the next, the landlords being leagued together, and his body was easily disposed of. One wonders why, with the cañon close at hand, the victims should have been buried; yet we were shown a pit near one of the houses in which it was said a large number of skeletons had been found, when justice finally overtook the murderers.

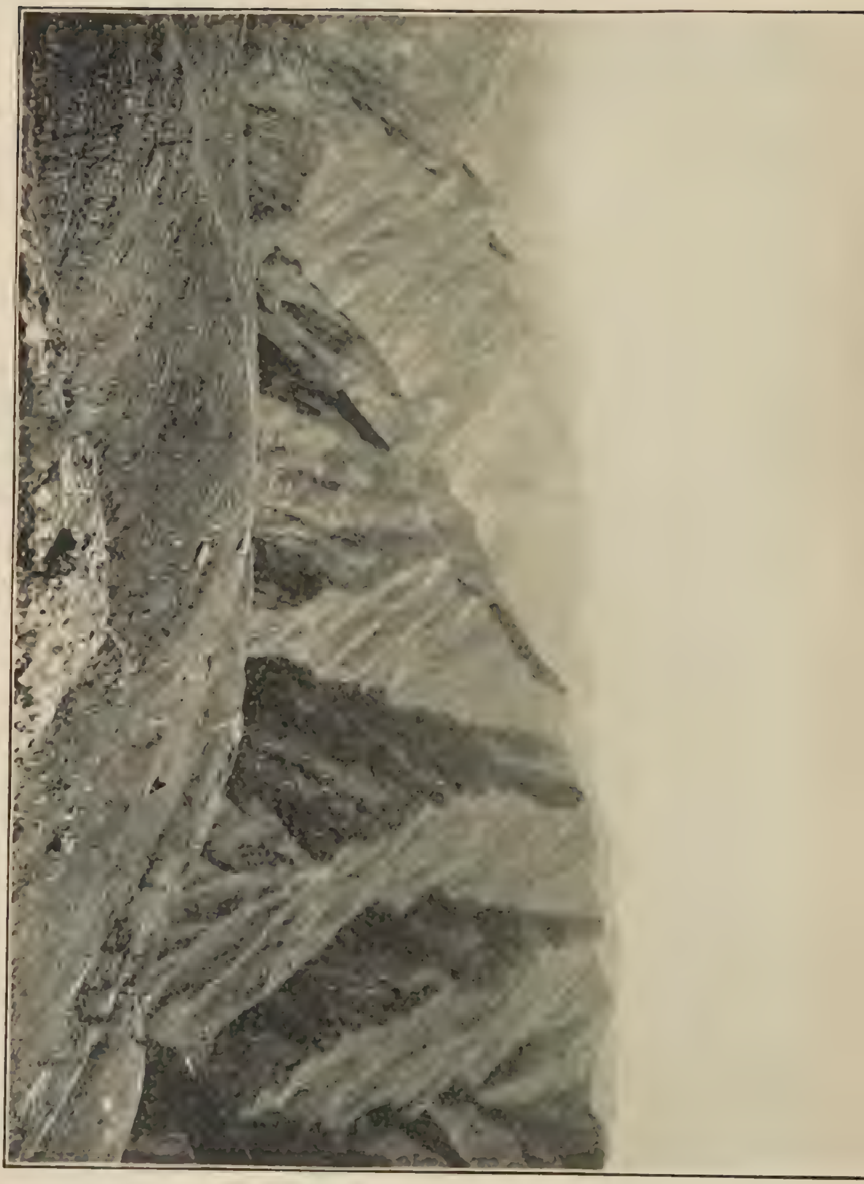
At the little village of Siau-wön-kien we found thirty or forty people remaining from a population that had once numbered several hundred. Abandoned houses and stores were in ruins, and a richly-painted idol of Kwang-shöng-ti, the protector of the people, continued to gaze fiercely but helplessly on a scene of destitution. The wealth of the place had vanished with the utter destruction of the forest. A disease had attacked the potatoes, the oats had failed, and wild hogs, appearing in droves, had become a pest against which the farmers could not protect themselves. In one case we saw fields freshly uprooted, and near-by was a newly-abandoned house. And yet here, in this poverty-stricken community, a gift was volunteered by the head man; a basketful of potatoes and walnuts, a white chicken, a little maccaroni, and some oat flour. He came accompanied by two or three friends, and talked with us a few moments—his first interview with foreigners.

I was at a loss for an equivalent gift, our supply being low and not well suited to the villagers' needs, but I bethought me of the generous outfit of thread, needles, and pins which had been provided for my own use. Four needles, two rows of pins, two safety-pins, eight hooks and eyes, a spool of cotton, and a cake of chocolate made up the return gift. Li told me it gave much pleasure, most of the articles being the first of their kind the people had seen. Needles they had, coarse Chinese ones, but not such cotton thread—so strong, so smooth.

Approaching Siau-wön-kien, the route taken by our coolies again led through a gorge and often crossed the flooded river. One of the bearers, an old man, was swept away by the stream and roughly handled among the boulders before he was rescued. It was reported that he was drowned, but he was presently brought to meet me as I hastened to see what might be done for him. Trembling with fear, his ragged clothes clinging to him, the poor old fellow threw himself on hands and knees before me and struck his forehead on the ground. He was imploring pardon for having wet his pack! I raised him and again he prostrated himself. Then one of the boys told him to stand up, and he stood, but shivering from chill and nervous shock. We poured him hot brandy and water, which he drank eagerly; then one of our T'ients'in boys, whose good heart we had more than once had occasion to recognize, took the old man into a room, rubbed him down hard, and lent him dry clothes. Later I called my boy: "Sha-ehr-ko!" Yees, sir." "How old man?" "Old man very hot, sir; very hot."

From Siau-wön-kien to the foot of the pass, a distance of twelve miles, we were told to expect forty fords; and we certainly realized them, though the flood had somewhat run down before we attempted them. In its upper stretches the river had become a jolly, rollicking, boisterous stream, with many rapids and falls over ledges of hard rock, which also form bolder cliffs than the banks of slate farther down. By many of the fords a little shrine was built in the cliff, and within were grotesque dolls, idols to which the mountaineers pray before trying to cross. As offerings to the spirit of the place they also place on end, on convenient ledges above the stream, long stones, simply picked up in the shingle. This custom, which was evidently much practised, has its origin in India.

We crossed the range at a pass marked by the ruins of an old temple called the Wön-kung-miau, and at an elevation of only 7,700 feet. The highest summit near-by was 9,700—a broad-



SUMMITS OF THE TS'IN-LING-SHAN, THE BARRIER RANGE OF CHINA, LOOKING SOUTH TO THE MAIN DIVIDE. HEIGHTS, 8,000 TO 10,000 FEET.

shouldered, massive mountain, and the general altitude of the hills on many ridges reaching far to the northeast and south was about 8,500 feet. Thirty miles to the southwest the Ta-pai-shan, a range marked on many European maps, towered to 11,500 feet, and in the latter part of April was still covered with snow, which probably does not altogether disappear during the summer. The Ts'in-ling-shan is thus not a sharply-defined mountain chain, but a broad, even-topped uplift, carved by streams which flow in their principal courses north or south, with only a subordinate development of east-west valleys parallel to the range and the structure of the rocks. The northward-flowing streams fall 6,000 feet in thirty miles, to the valley of the Wei; those which flow southward have no greater total fall in seventy miles, to the valley of the Han. The northern spurs have a cold winter, wet spring, and short summer; the southern slopes lie in a mild, temperate climate and descend to a semi-tropical one. Near the divide are extensive forests of pine, spruce, and hemlock, mingled curiously, even up to 7,000 feet above sea, with thickets of bamboo. Thence we passed down through the zones—from where the snow still lay in sheltered nooks and trees were scarcely in bud to where cherries were ripe and palms stood among the luxuriant growth of early summer. We passed the lilac and rhododendron and a large purple columbine. Where the rhododendron reached its lowest limit, at 3,500 feet above sea, were the highest of the rice fields, which are terraced into every nook of the mountain side that can be irrigated. This is the natural home of the Wichuraiana rose. It hangs in festoons over trees and cliffs, and in the higher zone just coming into blossom it bore on each graceful drooping branch hundreds of pink-white buds. Thence for sixty miles it was rarely wanting and bloomed with wonderful profusion. One vine had a stem ten inches in diameter, and completely covered, as with a veil of white lace, a tall wide-spreading tree. Single sprays hung from high branches almost to the ground, bearing quantities of blossoms and swinging with upturned ruddy tips in the breeze. Less graceful, yet charming in their way, were two mimosas, the one pale lavender, the other gorgeous yellow, and lupines and pea vines covering whole fields. But among flowers of field or mountain side none vie with the poppy, the native's pleasure and his profit. It blossomed white as a lily and red as a jacqueminot, but often, also, of that sombre sang-de-bœuf hue, the shadow tone of rosy lights, which fittingly suggests the gloom into which the Chinese are drifting with phantoms of the opium dream. We first saw it unfolding its curling, scimetar-like leaves in the chilly upper air; then we passed on every hand its gorgeous nodding flowers; and lower down, their work done, the petals were falling and the pale green serpent's head stood up naked, not ugly in itself, but hideous in its potency of evil.

In the valley of the Pu-ho there was a well-established foot-path, suitable even for pack animals, and our difficulties were over when we crossed the summit. The way was easy to the Han River, which we reached at the walled city of Shï-chuan-hien, one hundred and ten miles from Chou-chlï-hien. We had crossed in twenty days, at a most unfavourable season, with many delays occasioned by weather and high water. Nowhere had we met with any real difficulty, and, judging by the accounts given by von Richthofen and others of the cañons through which the great southwestern highway between the Wei valley and Sze-chwan is built, the route which it takes offers much more formidable obstacles to the passage of the range than any we encountered. The pass we crossed and the approaches to it are entirely practicable for railway construction, and it is quite possible that still better ways might be found. The rocks above the active work of running streams are somewhat decayed and often soil-covered, yet firm underneath. When, in the development of the Chinese Empire, it becomes necessary to connect the valley of the Wei with that of the upper Han River at Han-chung-fu, there will be no difficulty in building that section of the great southwestern trunk line, even across the barriers of the Ts'in-ling-shan.

CERTAIN RELATIONS OF RAINFALL AND TEMPERATURE TO TREE GROWTH.

BY

HENRY GANNETT.

Of the various factors, climatic and otherwise, which affect the growth of forests and different species of trees, there are two which are of a primary character. These are annual temperature and annual rainfall—that is, the amount of heat and the amount of water. These two factors determine whether trees can grow, and if so, what species.

There are numerous other factors which have a modifying effect, among which are seasonal temperatures, seasonal rainfall, humidity of the air, evaporation, wind exposure, slope exposure, degree of slope, and soil texture and depth.

The roots of trees penetrate into the soil to such a depth that they are not affected by ordinary droughts. Whether a season is dry or wet matters little so long as the year's precipitation is sufficient. Trees are hardy plants, as a rule, and are not affected by short periods of extreme heat and cold. Hence, seasonal variations, either of rainfall or temperature, have little effect upon them. That this is true in regard to rainfall is shown by the fact that yellow pine flourishes upon the slopes of the Sierra, where most of the rain comes in the winter, and also upon the Colorado plateau in Arizona, where most of it comes in the summer.

Exposure to wind has, of course, a modifying influence in the distribution of trees, especially on high mountains; but it is not a determining factor. The timber-line is not caused by wind; if it were, trees would extend to the summits of the highest mountains on the leeward side. As it is, the effect of wind and of depth of soil is shown in the elevation or depression of the timber-line for a few hundred feet only.

Near the lower limit of the yellow pine in the Sierra Nevada this tree is seen to extend farther down upon the north slopes of the spurs, and in damp, sheltered places; but the effect of such slope exposure is seen for two hundred, or possibly three hundred, feet only, while the absolute disappearance of yellow pine at certain altitudes in the Sierra is due to some other cause, and certainly not to this or any of the causes above enumerated as secondary. The fact that this line coincides very closely from the north to the south limit of the United States with the isohyetal line of 20 inches is pretty good evidence that it is annual rainfall that induces it, whatever local variations may be introduced by secondary causes.

The fact that under the same rainfall and other conditions different species are found in tropical, temperate, and polar regions is evidence that the annual temperature is the determining factor in such cases.

If the foregoing is conceded, it would seem that the following is the logical order of entering upon the study of the relations of climatic and other conditions to the growth and distribution of trees:

1. The influence of the primary causes as above stated.
2. The modifying influences of the secondary causes.

The present paper is designed to show how much and what information our present knowledge of the climatic elements develops concerning tree growth in the western United States. The fact that in the matter of temperature only negative results have thus far been reached shows, to my mind, only the imperfections of our knowledge—imperfections which will be remedied by more extended and better-directed observation. In the matter of rainfall it seems to me that certain facts of importance have been developed—that is, the rainfall at the lower limits of forests in general, and of yellow pine, red fir, and redwood.

For several years past the United States Geological Survey and the Forestry Bureau of the Department of Agriculture have been employed in collecting information concerning the distribution of forests in the mountain regions of the West. The former organization has for the past ten years been engaged in the examination of forest reserves and adjacent lands, and in the preparation of land-classification maps of these areas. Furthermore, the topographers of the Survey working in this part of the country have, in addition to the preparation of topographic maps, prepared also land-classification maps.

The Forestry Bureau has in recent years made examinations and prepared reconnoissance maps of large areas which had been withdrawn from settlement with a view to creating forest reserves

The work of these two organizations taken together covers nearly all the forested land of the West and makes it possible to prepare a map of this part of the country showing the regions which are wooded or forested and the areas occupied by certain kinds of timber.

The distribution of timber generally and of the species above designated, with relation to the two chief elements of climate—temperature and moisture—is a matter of great interest. Knowledge of the limiting temperatures and limiting rainfalls within which timber in general will grow, and within which different species of timber will grow is of first importance in the study of forest environment.

The information concerning climatic elements has been obtained from the Weather Bureau, whose officers have placed at my disposal not only all printed data concerning temperature and rainfall, but all manuscript material in their possession. There are returns from probably one thousand meteorological stations scattered over the Rocky Mountain and Pacific Coast States. After discarding all stations in which the rainfall series is less than five years, I have the records of a little over four hundred stations.

Most of these stations present also a record of temperature, so that the temperature stations are between three and four hundred in number. The distribution of these stations is not, however, by any means what could be desired, the great majority of them being situated in towns and cities, and therefore in low and open or non-timbered country; and very few of them are high up in the mountains, so that in those parts of the West in which the timber is confined to the mountains the timbered regions are not well represented. This is especially true of the Rocky Mountain States, including Montana, Idaho, Wyoming, Utah, Nevada, Colorado, New Mexico, and Arizona. In these States nearly nine-tenths of the stations are in open country, only a few more than one-tenth being situated in the forests. In western Oregon and Washington, where the forests cover the valley lands as well as the mountains, there are naturally many stations in the forests. To a less extent this is true of northern California, but in southern California it is much the same as in the Rocky Mountain States. Hence it is that the information concerning the temperature and rainfall of the forested region in the Rocky Mountain States and southern California is scanty, while in northern California, western Oregon, and Washington it is much more abundant.

The mean annual temperature at any place is fairly constant year by year—that is, the mean temperature of one year differs but little from that of other years; hence it does not require a long period of observation to establish accurately the mean annual temperature at any locality. Moreover, the temperature is not much affected by topographic surroundings, so that the observations made at any place fairly represent the temperature of the neighbouring country. This is not, however, the case with rainfall observations. The surrounding topography, and even the location of the rain-gauge, materially affect the amount of rainfall and the amount of water collected, so that there is no assurance that the rainfall measured at the station represents the rainfall of any considerable area surrounding it. Further, the rainfall of different years differs widely. In a locality twice as much rain may fall in one year as in the year preceding or the year following, and it is only by obtaining the mean of a series of years that one is assured that he has the average rainfall of his station. It is owing to these uncertainties that one must use rainfall measurements with caution and should obtain the mean rainfall of a group of stations as that of a locality, rather than one station alone.

The figures for rainfall and temperature at all of the stations obtained were platted upon Land Office maps of the several States, and the outlines of timber sketched upon the same maps or upon different maps. In this way the location of the different stations was obtained with reference to the forests.

In this study the lands were first classified as *open* or *timbered.* The timbered lands were classified as *yellow pine, red fir, redwood lands,* and *"other timber."* In "other timber" are included lands covered with piñon, juniper, nut pine, and oak, which may be grouped under the designation "desert species."

The stations in each of these classes were taken off the map, with their rainfall and temperature. The average rainfall and temperature of each of these classes of lands was obtained from the figures. The stations were also grouped in each of these classes, the groups being for the temperature each five degrees and for the rainfall each ten inches. The results are set forth in tables:

TEMPERATURE.

States.	Average Temperature in Degrees Fahr.				
	Yellow Pine.	Fir.	Redwood.	Desert Species.	Open Country.
Arizona	54	..	..	62	65
Colorado	..	..	..	..	47
California (North)	51	..	54	61	60
California (South)	..	..	..	57	63
Idaho	..	..	..	..	48
Montana	44	..	..	..	43
New Mexico	..	..	..	52	56
Nevada	..	..	..	..	50
Oregon	50	51	..	..	47
Utah	..	..	..	..	49
Washington	46	50	..	..	48
Wyoming	..	..	..	..	42
Average temperatures of total stations	50	51	54	60	54

RED FIR.

Number of Stations in each Temperature Group.

States.	40°–45°	45°–50°	50°–55°	55°–60°
Washington	..	4	21	1
Oregon	1	..	22	..
Totals	1	4	43	1

OPEN COUNTRY.

Number of Stations in each Temperature Group.

States.	35°-40°	40°-45°	45°-50°	50°-55°	55°-60°	60°-65°	65°-70°	70°-75°	75°-80°
Colorado........	2	8	16	14	..	..	..	..	..
Arizona.........	..	..	1	3	..	12	9	8	..
Washington.....	..	1	8	5	..	..	..	..	..
Wyoming	3	11	7		..	..	..	..	..
Idaho	1	3	4	6	1	..	..	..	..
Montana	1	12	4	..	..	..	..	..	..
New Mexico....	..	..	2	3	5	3	1	..	..
Nevada.........	1	..	9	10	3	.	..	..	..
Oregon.........	..	1	6	2	..	..	..	..	..
Utah	1	1	14	14	1	..	..	..	..
California (South)	..	..	..	1	21	20	10	3	4
California (North)	..	..	1	8	13	30	7	..	..
Totals.......	9	37	72	66	44	65	27	11	4

YELLOW PINE.

Number of Stations in each Temperature Group.

States.	40°-45°	45°-50°	50°-55°	55°-60°	60°-65°
Arizona............	..	1	..	.	1
Washington...... ..	2	4	1	..	..
Oregon	1	1	7	..	..
California (North)...	5	2	12	3	3
Totals..........	8	8	20	3	4

DESERT SPECIES.

Number of Stations in each Temperature Group.

States.	45°-50°	50°-55°	55°-60°	60°-65°
New Mexico..................	..	2	..	..
Arizona	..	..	..	1
California (North)..............	..	..	5	18
California (South)........	1	..	6	..
Totals.....................	1	2	11	19

RED WOOD.

NUMBER OF STATIONS IN EACH TEMPERATURE GROUP.

STATE.	50°-55°	55°-60°
California	3	3

The table showing the average temperature of different classes of country is apparently of little significance, partly because of the irregular distribution of the stations, especially in certain of the timbered regions, and partly because there does not appear to be any characteristic difference of temperature in different regions. Because of the first of the above qualifications it is probable that the average temperature of the yellow-pine regions is too high, since most of the stations within this region are in the lower part of the timber-belt. The distribution of stations in the red-fir region is fairly uniform, and the temperature given in the table is probably not far from correct. The same is probably the case with the redwood region. Under the heading of "Open Country" are included the great plains, broad valleys, and desert regions generally, and the temperature of these regions differs widely in different parts of the country, from 42 degrees in Wyoming up to 65 degrees in the deserts of Arizona, and the average has little significance.

Classifying these stations in groups of five degrees of temperature each, it is seen that in the open country no less than 93 per cent. of the stations are found where the temperature ranges between 40 and 70 degrees. In the States of Wyoming and Montana there was no station with a temperature exceeding 50 degrees. In Colorado, Washington, and Oregon there was no station exceeding 55 degrees. On the other hand, in southern California stations are found ranging up nearly to 80 degrees, while there were none below 50 degrees.

The table relating to yellow pine shows that the greatest number of stations is found where the temperature is between 50 and 55 degrees, while the entire range of the species, as indicated by the stations, is from 40 to 65 degrees.

Nearly all the stations in the red-fir region are found between 50 and 55 degrees. Indeed, outside of this group the stations are but scattering.

In the redwood region all the stations are between 50 and 60 degrees.

Woodland shows a high temperature, nearly all the stations being between 55 and 65 degrees—that is, at the highest temperatures represented.

The upper limit of tree growth, or the timber-line, is a matter of temperature, and is not difficult of definition. In the "American Journal of Science" for 1882, page 275, I published an article entitled "The Timber-Line," in which I showed that the mean annual temperature of the timber-line in the United States is one or two degrees below freezing-point. The data for this result are as follows:

Given the height of the timber-line in feet, the height and the mean annual temperature of a station at or near the base of a mountain, and the fact that the mean annual temperature diminishes about three degrees in each thousand feet of ascent, the calculation of temperature of the timber-line is a very simple matter.

The result above given, which is set forth fully in the article referred to, is corroborated by more recent and extended investigation, and the separate results show a range of only four or five degrees. The fact that in different parts of the country the timber-line species differ does not appear to affect the result, since the same figure is obtained for Mount Washington, New Hampshire, Mount Marcy, New York, the mountains of Colorado and Montana, the Sierra of California, and the Cascade Range of Oregon and Washington.

The conclusion reached, that the timber-line has a mean annual temperature of approximately 30 degrees, makes the location of this isotherm a simple matter.

RAINFALL.

STATES.	AVERAGE RAINFALL IN INCHES.				
	Yellow Pine.	Fir.	Redwood.	Desert Species.	Open Country.
Arizona	23	..	..	15	9
Colorado	..	..	..	..	14
California (North)	44	..	44	30	18
California (South)	30	..	57	19	11
Idaho	24	..	..	..	12
Montana	21	..	..	..	15
New Mexico	..	..	..	20	11
Nevada	..	..	..	..	7
Oregon	31	56	..	..	13
Utah	..	..	..	16	11
Washington	21	56	..	..	15
Wyoming	..	..	..	..	12
Average rainfall of total stations	34	56	46	24	13

OPEN COUNTRY.

Number of Stations in each Rainfall Group.

States.	–10″	10″–15″	15″–20″	20″+
California	39	47	33	15
Wyoming	6	18	2	..
Nevada	20	3	1	..
Oregon	2	6	5	..
Washington	3	3	9	1
New Mexico	10	12	4	..
Arizona	22	14	3	..
Colorado	8	18	26	..
Montana	..	15	11	1
Idaho	3	10	1	1
Utah	15	13	7	..
Totals	128	159	102	18

YELLOW PINE.

Number of Stations in each Rainfall Group.

States.	–20″	20″–30″	30″–40″	40″–50″	50″–60″	6c″–70″	70″+
Arizona	..	2	..	..	..	..	..
California	1	8	5	8	8	3	1
Montana	1	3	..	..	..	..	..
Washington	2	5	..	..	..	..	..
Oregon	1	5	3	2	..	..	..
Idaho	2	5	1	..	..	..	..
Totals	7	28	9	10	8	3	1

RED FIR.

Number of Stations in each Rainfall Group.

States.	–30″	30″–40″	40″–50″	50″+
Washington	3	7	7	13
Oregon	..	8	13	19
Totals	3	15	20	32

REDWOOD.

Number of Stations in each Rainfall Group.

State.	–30″	30″–40″	40″–50″	50″
California	1	7	4	5

DESERT SPECIES.

NUMBER OF STATIONS IN EACH RAINFALL GROUP.

STATES.	−20″	20″–30″	30″
California	13	25	16
New Mexico	2	1	..
Arizona	6	..	..
Utah	2	..	..
Totals	23	26	16

The data relating to rainfall are more definite and much more significant than those of temperature. The table presenting the average rainfall of the different regions shows that the average of the open country is 13 inches and that of the different States ranges from 7 inches in Nevada up to 18 inches in northern California. The average rainfall under which yellow pine grows, as indicated by these data, is 34 inches, but owing to the irregularity in the distribution of stations its true average should probably be somewhat greater. The different States show for yellow pine a range from 19 inches in Wyoming up to 44 inches in northern California. The average rainfall of the red fir in Oregon and Washington is 56 inches and that of the redwood is 46 inches. In both these cases the figures probably represent very closely the facts. Desert species, with an average of 24 inches for the entire West, shows a range among the States from 15 inches in Arizona up to 30 inches in northern California.

These rainfall stations have been classified in groups of ten inches of rainfall, or, in the case of open country, by five inches. For the open country this classification shows that nearly all the stations—indeed, 96 per cent. of them—have less than 20 inches of rainfall, which appears to indicate that where the rainfall exceeds 20 inches one may expect to find the country wooded. Nearly all the stations in which the rainfall exceeds 20 inches—*i. e.*, fifteen out of eighteen stations—are found in California, and many of them are in the upper part of the Sacramento Valley.

Of the stations in the yellow-pine country, nearly all—fifty-nine out of sixty-six—are found where the rainfall exceeds 20 inches. This appears to indicate that the lower limit of the yellow pine is at or just below 20 inches of rainfall. The upper limit is not clearly defined, owing, probably, to scarcity of stations in the higher country. In California one station at least is found where the rainfall exceeds 70 inches, and there are twelve in which the rainfall exceeds 50 inches.

In the regions occupied by the red fir only three stations out of seventy are reported as having a rainfall less than 30 inches. This appears to indicate that the lower limit of the red fir is at or about 30 inches of rainfall. There is apparently no upper limit, the fir being found abundantly in regions where the rainfall exceeds 100 inches annually.

The redwood strip on the California coast includes but one station having a rainfall less than 30 inches, which appears to indicate that the isohyetal line of 30 inches is the lower limit of this species.

DRAINAGE MODIFICATIONS IN THE SOUTHEASTERN APPALACHIANS.

The following is an abstract of a paper by Prof. Douglas Wilson Johnson of the Massachusetts Institute of Technology which has just received one of the Walker prizes of the Boston Society of Natural History :

From time to time mention has been made of a capture of the former headwater portion of the Chattahoochee River, by the upper portion of the Savannah River, at the border between western South Carolina and northeastern Georgia. In the summer of 1905 the speaker spent several weeks in a study of the region in question. The results of this study appear to justify the following conclusions:

(1) The upper portion of the present Savannah River formerly flowed southwest through the Chattahoochee River into the Gulf of Mexico, but was diverted to the Atlantic drainage by a process of stream capture.

(2) The capture furnishes an example of what may properly be termed "remote capture," having occurred so long ago that much of the direct evidence has been obliterated.

(3) The capture resulted from the advantage enjoyed by the Atlantic drainage over the Gulf drainage, owing to the shorter course to the sea which streams of the former system traversed.

(4) Both the Tallulah and Chattooga Rivers (now tributary to the Savannah) occupy to-day the same general courses which they occupied before the capture, the combined waters of both streams having been diverted at the same time by a single instance of capture, which took place a short distance below their point of junction.

(5) The falls of the Tallulah River, while initially due to the capture by a stream at a much lower level, exist to-day, not because of the recency of the capture, but because of the presence of a hard rock barrier crossed by the Tallulah River, but not yet worn down by it.

(6) The similar falls which must have existed on the Chattooga and larger tributaries have been obliterated by those streams, not because they were captured first, but because the great lapse of time since the capture was ample for them more nearly to grade their courses in the less resistant rock over which they run.

The evidence upon which these conclusions are based consists, in part, of the entrenchment of the Tugaloo, Tallulah, and Chattooga Rivers, the higher and more open valleys of the tributaries to the Chattahoochee, the hanging valleys bordering the three first-named streams and their larger tributaries, the difference in hardness of rocks in the Tallulah gorge as compared with the other valleys, and the presence of old river gravels across the divide between the Savannah and Chattahoochee systems at this point.

GEOGRAPHICAL RECORD.

AFRICA.

Major Powell Cotton's Expedition.—Reuter's Agency received news (May 25) from Major Powell Cotton's Expedition, which left England eighteen months ago on a journey from the Nile to the Zambezi. At the end of March the explorer and his wife were at Makala, Congo Free State, in the heart of the Ituri rubber district and one of the chief haunts of the okapi, where the expedition proposed to remain for a month or so in a final endeavour to secure specimens. The progress of the expedition has created much interest among the pygmy and other forest tribes, Mrs. Powell Cotton being the first European woman to penetrate the Ituri basin, and the camp has been thronged daily with natives curious to see the "white woman with the long hair." The explorers were in good health and were receiving every assistance from the authorities.

Ascents in the Ruwenzori Range.—The Bulletin reported in the June number (p. 368) that three gentlemen had reached one of the peaks of the range. Information has since come almost simultaneously to London that the Duke of the Abruzzi has begun his ascent, and also that in April last Messrs. R. B. Woosnam, D. Carruthers, and A. F. R. Wollaston, three members of the zoological expedition sent to Africa under the auspices of the Natural History Museum, South Kensington, made two ascents in the Ruwenzori Range. On April 1, according to *Nature* (No. 1910, p. 132), they ascended Duwoni, the peak rising to the northeast of the Mubuku Glacier. This peak has two tops of apparently equal altitude; the southern top, which was reached, was found to be 15,893 feet. On April 3, they ascended Kiyanja, the peak at the western end of the Mubuku group of peaks. The altitude was found to be 16,379 feet. The altitudes were taken by aneroid and by the boiling-point thermometer. Both these peaks have been thought by different explorers to be the highest points in Ruwenzori, but from the summit of Kiyanja a still higher peak with two tops was seen in a northwesterly direction. The weather at this season of the year is very unfavourable, the mountains being almost constantly buried in clouds, with frequent snowstorms, which prevented the party from making further explorations.*

PROGRESS OF THE CAPE TO CAIRO RAILROAD.—On June 11, the British South Africa Company in London received a message that this railroad had reached the Broken Hill mines on that day. The Broken Hill mines consist of two low hills which are practically a solid mass of copper ore. The British South Africa Company has a large force of European miners there. One of the hills is being cut away by terracing and a tunnel has been cut through the other hill. The ore which the miners have accumulated may now be carried away for reduction. The railroad has been extended 2,016 miles north from Cape Town, and its completion to Broken Hill forms a further step towards the fulfillment of Mr. Rhodes's great scheme. Progress has been remarkable since the tracks crossed the Zambezi. The mileage completed north of the river is 374, and construction has been carried forward at the rate of nearly a mile a day. From 3,000 to 5,000 natives were constantly employed under the supervision of about 350 whites. Seven bridges were built of over 50-feet span, and the bridge across the Kafue River is 1,200 feet long. It is expected to extend a branch road into Katanga, the southeastern province of the Congo Free State, where the greatest gold and copper region of Central Africa is said to exist. This region has been explored by mining experts; but scarcely any development work has been done, owing to lack of communication with the rest of the world.

AMERICA.

DR. BAUER'S NEW POSITION.—The Carnegie Institution recently offered to Dr. L. A. Bauer the post of permanent Director of its Department of Terrestrial Magnetism. He has accepted the offer, and will hereafter devote his entire time to the Carnegie Institution work. For the past seven years he has been in charge of the magnetic survey and observatory work of the United States under the auspices of the Coast and Geodetic Survey. He organized and trained a corps of observers, established five magnetic observatories, and began the magnetic work of the Coast Survey vessels. Under his direction the general magnetic survey of the United States has been practically completed, the three magnetic elements having been observed at about 2,500 stations distributed over the United States and outlying territories. Various publications relating to this work have been issued.

The Carnegie Institution work, however, is developing into a general magnetic survey of the globe. The annual grants to the Department of Terrestrial Magnetism are sufficient to keep continuously in progress an oceanic magnetic survey in addition to the sending of expeditions to land areas where no magnetic surveys have as yet been made and also to carry out various auxiliary investigations. It is believed that this magnetic survey of the globe will be completed within the next fifteen or twenty years.

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* A telegram of July 5 from Rome announced that the Duke of the Abruzzi reached the summit of Mount Ruwenzori on the 18th of June.

WHAT IS KNOWN OF ALASKA.—Mr. Alfred H. Brooks of the U. S. Geological Survey writes in the *Popular Science Monthly* (Jan., 1906) that of the total area of Alaska, 620,000 square miles, just about one-half, or 310,000, is still unmapped and practically unexplored. The explorations of the U. S. Geological Survey have covered about 80,000 square miles; the geological and topographical reconnaissance surveys, 60,000; shore-line surveyed by Coast Survey and some geological surveys by the Geological Survey, 120,000; and explorations by other departments of the Government, 50,000. All but two of the larger rivers have been surveyed, and contour maps have been made of over 150,000 square miles. All of the larger geographical features have been outlined by the network of explorations which have been extended over the entire Territory. There are no mountain ranges yet to be discovered, though several are still imperfectly known. Every mining district in Alaska has been reported upon, and inquiries in regard to the mineral resources of any part of Alaska are answered with a printed report issued by the Geological Survey containing the latest and most authentic information. Much still remains to be done, for over half the Territory has not yet been covered by even reconnaissance surveys.

WORK ON THE TRANSANDINE RAILWAY.—Mr. John Hicks, U. S. Minister to Chile, has written to the Department of State that the section of this railway from Salto del Soldado to Juncal has been opened to traffic. This is the railway over the Andes to connect the cities of Buenos Aires and Valparaiso, and will be the first road south of the Isthmus of Panama to join the two oceans. It is being constructed jointly by the Republics of Chile and Argentina. The portion of the line still uncompleted is only about ten miles in length; but it includes a long tunnel through the summit of the Andes, and it is estimated that it will take at least three years to complete it. Travel on this road began as early as 1888, when the two ends of the railway were 75 miles apart. From the Argentine end to Buenos Aires the track is in good condition, and the journey is made in twenty-four hours. As yet, however, transit across the mountains is only possible in the summer season on account of the snow, which accumulates during the winter months in immense quantities and frequently descends to the lower levels in the form of avalanches. It is said that the ordinary snowshed of the Rocky Mountains will be worthless here, and the construction of tunnels or other means of protection strong enough to safeguard the track so that trains may run in winter is an engineering problem not yet satisfactorily solved.

THE CENSUS OF THE CITY OF BUENOS AIRES.—The City Government of Buenos Aires has issued a large octavo volume, of 557 pages, in French, under the title "Recensement Général de la Ville de Buénos-Ayres," giving the results of the census of 1904, with discussions of every phase of the work of the municipal administration and of the city's social condition, commerce, and industries. Buenos Aires has long been notable for the excellence of its statistical compilations, its *Monthly Bulletin* giving all the statistics for each month. The population on Sept. 18, 1904, was 950,891, having increased 287,037 in nine years and four months. According to recent figures, the population of the capital on Dec. 31, 1905, was 1,025,653—an increase of 74,762 in less than fourteen months, showing that the population is still rapidly growing.

In territorial extent the city surpasses Berlin and Paris, but is exceeded by London and Vienna, the latter being now the largest city in area on the European mainland, though its density of population is less than in many of the larger cities. There are in Buenos Aires 51 inhabitants to the hectare (2.47 acres), while Paris has 340, London 145, New York 202, Berlin 285, Vienna 89, Brussels 204, and St. Petersburg 135 inhabitants to the hectare. Over one-third of the residents of Buenos Aires, or 320,589 persons, were born in the city. Many of the inhabitants, since 1895, have moved out of the more crowded districts into the peripheral territory, to which electric tram cars afford cheap transportation, while cheap lands, low rents, and purer air are attractive inducements. There were 17,985 commercial houses containing merchandise and fixtures worth 520,706,300 pesos (a peso=95.5c.) and giving employment to 79,547 persons, of whom 64,154 were men and 15,393 women. It is an interesting fact that persons of foreign birth form a large majority of the employés, foreigners numbering 49,951 and Argentines 29,496. The book is illustrated with a map of the city and a considerable number of photographs, including a fine panoramic view of Buenos Aires as seen from above the new docks on the river front.

SAVAGE TRIBES OF THE AMAZONIAN REGION OF PERU.—Mr. von Hassel claims to base his knowledge on ten years of intercourse in the forests of the Marañon and Amazon. He gives a profusion of names which he calls tribal, and makes some remarks on customs and languages.—(*Boletin de la Sociedad Geográfica de Lima.* Año XV, Vol. XVII, first quarter, 1905.)

ASIA.

DR. SVEN HEDIN'S JOURNEY THROUGH PERSIA.—The BULLETIN (May, 1906, p. 311) announced the arrival of Dr. Sven Hedin in Seistan after a very fruitful journey, in the course of which he crossed the Dasht-i-Kavir, the great salt desert, three times. Letters have since reached England from which the London *Times* (No. 1,534, weekly edition) prints more details of the explorer's experiences. When he left Sweden in October last to travel to India, *via* Turkish Armenia, Persia, Seistan, and Baluchistan, he intended to make only a hurried journey through those countries, as his main field of work lay on the other side of the Himalayas. He found the opportunities for exploration between Teheran and Seistan so tempting, however, that he was nearly four months instead of two months on the road, and worked harder than ever before in the field.

From Veramin, a little southeast of Teheran, he went to Siah Kuh or Black Mountain and Kuh-i-Nakshir, where he found the western edge of the Dasht-i-Kavir as sharply drawn as any shore-line. He describes the desert as like the bottom of a big inland lake, full of salt mud and presenting an absolutely level surface. After turning aside to visit the Haus-i-Sultan lake, the explorer travelled in a generally southeast direction to Yandak, on the southern border of the Dasht-i-Kavir. Here he left his main caravan, and, taking two men and four camels, marched north across the desert to Turut, afterwards crossing south again to Khur. Rain fell, and the camels could go only slowly through the salt mud, so that Dr. Hedin made most of the journey on foot.

He says he has been able to construct a very good map of the Dasht-i-Kavir, of which the mapping thus far has been quite inadequate. From Khur he continued his journey eastward to Tubbas, one of the most charming oases he ever saw, with veritable forests of palm trees. Thence he passed southeast to Naiband, an even more delightful spot than Tubbas, turning aside *en route* for a couple of days' excursion into the Bahabad desert, which was marked on the maps as unexplored. From Naiband he proceeded to Neh, and thence to Nasretabad in Seistan.

He says that the explorer may still find plenty of work in eastern Persia. He carefully mapped the country along his route, and was able to make several corrections in earlier maps. His map work occupies 162 sheets, and in addition he made a panoramic sketch of the surrounding mountains at every camp from which mountains were visible, or at fifty out of sixty-eight halting-places. Most of these panoramic views are eight feet in length, and some of them are coloured. In addition, he made more than 100 sketches of typical Persian figures and secured between 400 and 500 photographs. Specimens of rocks were collected to the number of 200, and at two places fossils and molluscs were found. As usual with Dr. Hedin, written observations form the main part of his results, and on this journey he compiled 1,200 pages of manuscript notes. The plague was raging in Seistan when he arrived there in the early part of April. Writing on April 14, Dr. Hedin announced his intention of leaving Nasretabad two days later for Nushki, whence he proposed to make his way across India to Simla.

THE SURVEY OF INDIA.—A Committee was appointed in 1904 to examine the methods and workings of the Survey of India Department with special reference to the revision and reproduction of the topographical maps of the country. The report of the Committee has been issued in two volumes as "Report of the Indian Survey Committee, Parts I and II, 1904-1905," illustrated by a considerable number of maps. It goes into the history, methods, and cost of the survey, the state of the maps in each province, and the measures required to bring them up to date.

The gist of the Committee's recommendation is that the Department be strengthened in all that pertains to the topographic or military mapping of India and that the Topographical Survey be hereafter separated from the Cadastral or revenue survey, which shall in future be undertaken by the local civil administrations under supervision from the central Department.

Everything will be secondary in importance to the paramount necessity for maintaining a complete and thoroughly up-to-date one-inch map of all India and of all the frontier within the Indian political sphere of influence. With regard to map reproduction, the Committee recommends the partial engraving of maps and the introduction of heliozincography to replace the crude processes of photozincography. In accordance with the recommendation of the International Geographical Congress for the preparation of maps on the scale of 1:1,000,000, the Indian Survey has thus far issued a few sheets on this scale, and the Committee believes that its continuance may be sanctioned for the whole interior of India.

ARCHÆOLOGICAL SURVEYS IN INDIAN BORDERLANDS.—The Government press at Peshawar has issued a quarto volume of 56 pp. with 12 photographic plates containing Dr. Stein's report on his "Archæological Survey Work in the North-West Frontier Province and Baluchistan." The report gives fresh evidence of Dr. Stein's indefatigable industry and of the wide range of his erudition. He has been examining the ancient sites and traditional remains on the North-West

Frontier of India, and has apparently left nothing unvisited that might contribute to the interest of Indian archæology. One question which was thought to be settled he leaves involved in doubt. The situation of the celebrated rock fastness of Aornos, the capture of which figures so prominently in all classical accounts of Alexander the Great's campaign on the Indian frontier, was supposed to have been determined by the researches of the late Col. Abbot, who decided that it must have occupied the heights of Mahaban. Dr. Stein proves, however, that there is nothing in common between Mahaban and the rock described by Arrian, and no trace can be found on top of the mountain of the plateau described by the classical historians.

Besides disposing of Mahaban, Dr. Stein has rendered valuable service by identifying the site of Buddha's "body offering," or the holy spot where he offered his body to feed a starving tigress—a site which for ages was one of the most sacred bournes of Buddhist pilgrimage. Applying his gift of topographical analysis and his remarkable knowledge of legendary lore and oriental scholarship to his observations, Dr. Stein has no hesitation in assigning the site of that ancient gathering-place of the faithful to the hill of Banj, south of Mahaban. He found here ruins that coincide closely with the detailed description of the sacred "temple of the collected bones" and its surroundings.

TIME ZONES IN CHINA.—The Imperial Maritime Customs of China, some time ago, called attention to the advantage of time zones, which had already been introduced in Japan and the Philippine Islands. In accordance with the suggestion, China proper was divided into two zones, the western of which is called the seven and the eastern the eight hour zone east of Greenwich. The eight-hour zone comprises all the provinces between 112° 30′ and 127° 30′ E. Long. The seven-hour zone includes all the provinces of China proper west of 112° 30′ E. Long. The eight-hour zone thus includes all the treaty ports along the coasts from Newchwang in the northeast to Swatow in the south and the river ports as far west as the great Yangtse port Hankow.

A difficulty arose with the time zone at the treaty ports of Canton and Samshui because they are in close relations with Hongkong and Macao, where local time was still in use. The Imperial Maritime Customs, therefore, communicated with the colonial authorities, and both colonies consented to be included in the time zone. For convenience it was also decided to include the treaty ports of Hoihao and Pakhoi in the eight-hour zone, though both are west of the zonal dividing line. The clocks of Hongkong were put ahead 23 minutes and 8 seconds.

Most of the people do not yet realize the advantages of the time-zone system, but it is expected that they will soon learn to appreciate the ease with which they may reckon the time in every other place; and there is no doubt that the importance of this reform will increase with the development of railroads and the ultimate connection of the Chinese lines with the railroad net of Siberia and Europe.—(Condensed from *Mitt. der K. K. Geog. Gesell. in Wien,* Vol. 49, Nos. 3 and 4.)

EUROPE.

THE BERNESE OBERLAND.—The May number of the *Deutsche Alpenzeitung* is entirely given to description of the various parts of the Bernese Oberland illustrated by half-tone photographs and coloured plates that are a conspicuous feature of this periodical. One of the photographs is a splendid view of the northwest front of the Wetterhorn with the valley and village of Grindelwald in the foreground; another view shows the remarkably serrated surface of the upper part of the Grindelwald glacier with the bordering flank of the Schreckhorn. The coloured views include the Finsteraarhorn and the Oeschinensee, which, in its setting of mountains, is one of the finest of the smaller Alpine lakes. The Jungfrau narrow-gauge railroad is now half built, and was utilized through the season last year (four months) by 73,333 passengers.

INTERNATIONAL CONGRESS FOR THE STUDY OF THE POLAR REGIONS.—This Congress will be held at Brussels in September, 1906. The meetings will take place Sept. 7, 8, 10 and 11, at 10.30 A.M. and 2.30 P.M. each day.

Government delegates, delegates of Academies, Institutes and learned Societies and persons who have been upon the staff of a scientific expedition to the polar regions will be enrolled as *Acting Members,* without payment of any fee. All others pay a subscription of 20 francs and will be admitted as *Honorary Members.*

A lady's ticket is placed at the disposal of each member.

A circular of information will shortly be sent.

Those Members and ladies provided with tickets, who put their names on a special list, will take the train at 8.21 A.M. on the 12th of September for Paris, and on the 14th Sept. at 9.20 A.M. for Marseilles, where, on Saturday the 15th, they will take part in the Closing Reception of the Alliance Française and Geographical Societies and visit the Colonial Exhibition.

The French authorities have intimated their intention of offering a complimentary excursion in the Mediterranean.

Applications for membership to be addressed to M. Lecointe, Observatoire royal de Belgique, à Uccle, Belgium.

THE NEW PORT IN WALES.—A new port will be opened in August at Fishguard, on the Pembrokeshire coast of Wales, overlooking St. George's Channel. At a spot where the sea, a few years ago, washed against the sides of the hills, a deep-water port has been created by blasting out the rock to a depth of 150 feet and using the débris to build a long breakwater. The Great Western Railway Company has completed a railway station, galleries along the sea wall to facilitate the landing of cattle, and six miles of railroad tracks and sidings. The natural protection afforded to the harbour by the hills on three sides of the fine bay is completed by the breakwater, which will have a length of 2,500 feet. The water area of the harbour thus perfectly protected is 500 acres. Travellers by this new route to South Ireland will be able to leave London after breakfast and reach the Lakes of Killarney the same evening. The London *Times* (weekly, June 1) says it is believed that Atlantic liners bound for Liverpool or Glasgow will find it to their advantage to call at Fishguard, and thus save time, especially with regard to mails and passengers.

POLAR.

THE EAST GREENLAND EXPEDITION.—The Danish Government and private citizens have raised about $70,000 to fit out the proposed expedition under the leadership of Mr. L. Mylius Erichsen to East Greenland. The party sailed from Copenhagen June 29 and will make its way as far north as possible along the east coast of Greenland. The purpose is chiefly to map the unexplored part of the east coast and to look for anthropological remains. The leader expects to winter on the coast, and, from the most northern point of Greenland, he will attempt, in the spring of 1907, to reach the Pole. In his opinion the highest point of Greenland is the most favourable place from which to make this attempt. His northern sledge expedition will return in time to winter on the ship during the second year. In March, 1908, Mylius Erichsen, accompanied by one of his staff and two Greenlanders, hopes to traverse the inland ice across the broadest portion of the island. He thinks he may make this journey in about two and a half months, travelling partly by motor car, partly by dog sledge, and partly on ski.

THE PEARY EXPEDITION.—Many who are interested in Peary's enterprise are already beginning to ask when news may be expected from him. Under the most favourable circumstances, news cannot be expected earlier than September. If he is successful in reaching the Pole, and all circumstances are as favourable as might be conceived—which is not probable—a cable dispatch from him at the telegraph station in South Labrador may announce in September his good fortune and his return to civilization. If no news from him is received next fall it will be pretty good evidence that he requires another year at least to complete his work. If he does not come home this year it is not improbable that we may still have news from him. If, as is hoped, he succeeded in reaching his proposed headquarters on the shore of the Arctic Ocean, it may be that he started a small party of Eskimos south last spring giving news of the winter experiences of the expedition. If such dispatches were sent south they would be held at Cape York for the arrival of the Dundee whalers, and would reach America by cable from Dundee in November next. In this case Mr. Peary's friends and the geographical world will have information of his winter in north Grant Land. Unless he was able to carry out his sledging programme last spring we are not likely to hear of his final results for a year to come.

MR. A. H. HARRISON'S EXPEDITION.—Mr. Harrison, who started for the Mackenzie delta last year for the purpose of exploring the western part of the Parry Archipelago and looking for land in unknown Polar waters, writes to the *Geographical Journal* (June, 1906) that he left Athabasca Landing on July 22, 1905, in a boat built to transport his supplies and reached the Arctic Red River on Oct. 4th, where he was stopped by ice. During the winter he made a short-route survey, with perambulator, prismatic compass, and sextant, of the winter trail from Red River to the Peel, down the latter from Fort McPherson to its mouth, and up the Mackenzie to the Red River again. Observations for latitude and variation were made on this journey as well as during his descent of the Mackenzie. The winter was early, the snow exceptionally deep, and temperatures of —68° Fahr. occurred. To avoid losing a year, he left his goods behind and went on to Herschel Island in February, finding Lieutenant Hansen and the members of the *Gjöa* excepting Captain Amundsen, who had gone to Eagle City. Mr. Harrison hoped to make his way in April to Baillie Island and thence to Banks Land, where he proposes spending next winter.

VARIOUS.

GEOGRAPHY IN COLUMBIA UNIVERSITY.—In addition to the courses in physical and regional geography in Teachers College, Columbia University, under charge of Professor Dodge, a lectureship in Historical and Political Geography has been established in the University, and Prof. E. L. Stevenson of Rutgers College has been appointed to the position. While still continuing his work at Rutgers, Prof. Stevenson will carry on two courses at Columbia: a course for undergraduates in political geography, in which the influence of geographical environment upon the history of people and States will be emphasized, and a course for graduate students on the expansion of geographical knowledge—a subject that will include both the growth of geographical conceptions and the development of cartography. Prof. Stevenson's lectures will be begun in October.

COMMERCIAL STUDIES IN THE UNIVERSITY OF WISCONSIN.—The Society has received from the University of Wisconsin *Bulletin* 126, which gives the course in commerce for the coming academic year. These studies include a number of topics of geographical importance, such as transportation, the consular service, commercial geography, and physical geography and physiography. The course was opened to students at the beginning of the academic year 1900-1901. The attendance, liberal from the beginning, has steadily increased and the number of students in the past year was 225.

THE UNIVERSITY OF MONTANA BIOLOGICAL STATION.—A *Bulletin* of the University announces the eighth session of its Biological Station at Flathead Lake from July 11 to Aug. 16. This Station has become well known to American naturalists, and fifteen States have been represented in the early sessions. It is near the shore of Montana's large inland lake, which spreads over 300 square miles; the rapids of Swan River are at the door, and snow-capped peaks are near at hand. The Station will give courses in zoology, botany, photography, nature study, physiography, and special research. Eastern students who desire further information may address Morton J. Elrod, Director, Missoula, Montana.

Dr. Henry E. Crampton, Professor of Zoology in Barnard College, Columbia University, has returned from a scientific expedition of three months to the island of Tahiti in the Society group. He went for the American Museum of Natural History to study various species of mollusca which have undergone individual evolution in the isolated valleys of that island.

Edward Brückner, Professor of Geography in Halle University, has been called to the Chair of Physical Geography in Vienna, vacated by Prof. Penck. Together with Penck, he wrote "Die Alpen im Eiszeitalter" (1901-03). Both in physiography and hydrography he has shown himself to be a scientific investigator of original power.

Dr. Albert E. Jenks has been elected to an Assistant Professorship in the Department of Sociology at the University of Minnesota. He was recently chief of the Ethnological Survey of the Philippine Islands, and wrote the notable report on "The Bontoc Igorot," published by that Survey and reviewed in the BULLETIN (p. 575, 1905).

D. W. Johnson, Assistant Professor of Geology at the Massachusetts Institute of Technology, has been appointed Assistant Professor of Physiography at Harvard University.

Mr. Willis Moore, Chief of the U. S. Weather Bureau, has received the degree of Doctor of Science from St. Lawrence University.

The Royal Geographical Society of Australasia, Queensland Branch, celebrated the twenty-first anniversary of its foundation in the last week of June.

The Paris Société de Géographie has presented one of its gold medals to Major C. H. D. Ryder for his services as surveyor and explorer in connection with the recent Tibet Mission and his expedition to the sources of the Brahmaputra.

The *Geographical Journal* for June reports the proceedings at the meeting of the Royal Geographical Society on the 9th of April, when the American Ambassador presented to Captain Robert F. Scott, R. N., the Cullum Geographical Medal awarded to him by the American Geographical Society for the voyage of the *Discovery* and his sledge journey to Lat. 82° 17′ S., 1901-1904.

DR. JOSEPH KÖRÖSI DE SZÁNTÓ, founder and for forty years director of the Statistical Bureau of Budapest, died in that City on the 23rd of June after a long illness, at the age of 62 years.

Dr Körösi was also director of the Library of Budapest and a member of the Hungarian Academy of Sciences. His name was known and respected in many lands.

U. S. BOARD ON GEOGRAPHIC NAMES.—DECISIONS June 6, 1906:

ALEXAUKEN: creek, tributary to Delaware river at Lambertville, and railroad station, Hunterdon County, N. J. (Not Alexsocken.)

AMARGOSA: range, Inyo County, Cal.

ARENA: creek, flowing into San Luis Lakes, Costilla County, Cal. (Not Meadow nor Rito Arena.)

BEAR: creek, Jefferson County, Colo. (Not Turkey.)

BEAR: creek, Montezuma County, Colo. (Not South Fork Dolores nor Bear river.)

BECKWITH: pass, through Sierra Nevada near Chilcoot, Plumas County, Cal. (Not Beckwourth.)

BELTED: peak, most northerly high summit of Belted Range, Nye County, Nev.

BIRCHRUNVILLE: village, in West Vincent Township, Chester County, Pa. (Not Birch Run Ville nor Birch Runville.)

BLACKHEAD: peak, in San Juan Mountains, Archuleta County, Colo. (Not Corona.)

BRIER: spring, in Grapevine Mountains, Nye County, Nev. (Not Wild Rose.)

BRISTOW: town, Prince William County, Va. (Not Bristoe.)*

CLARK FORK: river, in Montana, Idaho, and Washington. (Not Silver Bow, Silverbow, Deer Lodge, Deerlodge, Hell Gate, Hellgate, Missoula, Bitter Root, Bitterroot, nor Clarks river.)

COCHETOPA: creek, hills, pass, town, precinct, and forest reserve, in southwestern Colorado. (Not Cochetopah.)

COTTONWOOD: creek, a left-hand branch of San Luis Creek, Saguache County, Colo. (Not Wildcherry.)

CRATER: flat, between Joshua and Bear Mountains, Nye County, Nev.

CRESTONE: creek, Saguache County, Colo. (Not Crestones.)

CRYSTAL: creek, flowing into the Black Canyon of the Gunnison, Gunnison County, Colo. (Not Rio Contrario.)

CURECANTI: creek, a right-hand branch of Gunnison river, Gunnison County. Colo. (Not Vincennes.)

DOLORES: mountain, in Dolores County, Colo. (Not Dunns Peak.)

EAST: river, a right-hand branch of Gunnison river, in Gunnison County, Colo. (Not Slate.)

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* Reversal of former decision.

EMIGRANT: wash, southwest of Mesquito Flat, Inyo County, Cal.

FARALLON: islands, off the coast of California. (Not Farallones de los Frayles, Farallone, nor Farallones.)*

FUNERAL: mountains, part of the Amargosa Range, south of Boundary Canyon, Inyo County, Cal.

GATO: creek, Conejos County, Colo. (Not Gata nor Los Gatos.)

GOLD: flat, west of Quartzite Mountain, Nye County, Nev.

GRAPEVINE: mountains, part of the Amargosa Range, north of Boundary Canyon, Inyo County, Cal.

GRAPEVINE CANYON: pass, through Amargosa Range, Esmeralda and Nye counties, Nev. (Not Bethune Pass.)

HAYWARDS: town and railroad station, Alameda County, Cal. (Not Haywards Station, Hayward's, Hayward, nor Haywood.)

HIGBEE: canyon, Otero County, Colo. (Not Reilly's.)

HORSEFLY: creek, a right-hand branch of San Miguel river, Montrose County, Colo. (Not Muache.)

HUERTO: creek, a right-hand branch of Rio Piedra, Hinsdale County, Colo. (Not Middle Fork Piedra.)

JARRE: creek, a left-hand branch of Plum Creek, tributary to South Platte river, Douglas County, Colo. (Not Garber nor Jug.)

KEYSTONE: bay, west of Keweenaw point, on the south side of Keweenaw Peninsula, Keweenaw County, Mich. (Not Union.)

KEYSTONE: point, west of Keweenaw point, on the south side of Keweenaw Peninsula, Keweenaw County, Mich.

LA VETA: peak, Sangre de Cristo Range, Huerfano County, Colo. (Not Veta.)

LONE CONE: peak, San Juan Mountains, Dolores and San Miguel counties, Colo. (Not West Point.)

MARBLE: canyon, Panamint Range, Inyo County, Cal.

MESQUITE: flat, in Death Valley, Inyo County, Cal. (Not Mesquite Valley nor Northwest Arm Death Valley.)

MIDDLE: creek, a left-hand branch of Cucharas river, Huerfano County, Colo. (Not Locust.)

MILBANK: city, Grant County, S. Dak. (Not Millbank.)

MOOYIE: river, Kootenai County, Idaho. (Not Methow nor Moyea.)*

MOUNT OSO: peak, San Juan Mountains, Hinsdale County, Colo. (Not Hunchback.)

MOUNT WILSON: peak, San Juan Mountains, San Miguel County, Colo. (Not Glacier.)

MOSCA: creek, Saguache County, Colo. (Not Sand.)

OBSIDIAN: butte, on Pahute Mesa, Nye County, Nev.

OLD BALDY: peak, Sangre de Cristo Range, Costilla County, Colo. (Not Baldy.)

PAHUTE: mesa, Nye County, Nev.

PILLAR: spring, at foot of Quartzite Mountain, Nye County, Nev.

PINE: creek, a left-hand branch of South Cherry Creek, Douglas County, Colo. (Not Piney.)

PINEY: creek, a right-hand branch of Cherry Creek, Arapahoe County, Colo. (Not Pine.)

POQUONOCK: village, railroad station, lake, river, and plains, New London

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* Reversal of former decision.

County, Conn. River, tributary to Bridgeport Harbor, Fairfield County, Conn. Village, in Hartford County, Conn. (Not Poquonock Bridge, Poquonoc, Poquonnock, Pequonnock, Pequonnoc, Pequannock, Poquanoc, nor Poquannoc.)

PUCKETA: creek, Westmoreland and Allegheny counties, Pa. (Not Big Pucketa, Big Pucketta, Puckety, Poketo, Paucatoes, nor Pocatoes.)*

QUEEN ANNES: county, Maryland. (Not Queen Anne nor Queen Anne's.)*

REDCLOUD: peak, Hinsdale County, Colo. (Not Red.)

RIO BLANCO: river, a left-hand branch of San Juan river, Archuleta County, Colo. (Not Rio Blanca nor White.)

RIO GRANDE PYRAMID: peak, San Juan Mountains, Hinsdale County, Colo. (Not Simpson.)

ROEDER: creek, a right-hand branch of Bear Creek, tributary to Turkey Creek, Clear Creek County, Colo. (Not South Fork Bear.)

ROSE: spring, in the southern part of Kawich Range, Nye County, Nev. (Not Wild Rose nor Wild Horse.)

ST. CATHERINES: island and sound, Liberty County, Ga. (Not St. Catherine's nor St. Catherine.)

ST. CHARLES: town, Pueblo County, Colo. (Not San Carlos.)

SAPINERO: creek, a right-hand branch of Gunnison river, Gunnison County, Colo. (Not Indiana.)

SARCILLO: canyon, Las Animas County, Colo. (Not Zarcillo nor Sarcilla.)

SARCOBATUS: flat, north of Amargosa Range, Nye County, Nev. (Not Mirage.)

SILENT: canyon, south of Gold Flat, Nye County, Nev.

SKELETON: hills, west of Specter Range, Nye County, Nev.

SKULL: mountain, north of Specter Range, Nye County, Nev.

SLATE: river, a right-hand branch of East river, tributary to Gunnison river, Gunnison County, Colo. (Not East.)

SOUTH RIVER: peak, San Juan Mountains, Mineral County, Colo. (Not Macomb.)

SPECTER: range, Nye County, Nev.

SUCKER: creek, a tributary of Snake river, Malheur County, Oreg., and Owyhee County, Idaho. (Not Snake nor Succor.)

SURFACE: creek, a right-hand branch of Gunnison river, Delta County, Colo. (Not East Fork Winnemucca.)

TAYLOR: river, a right-hand branch of Gunnison river, Gunnison County, Colo. (Not Spring.)

THIRSTY: canyon, in Pahute Mesa, Nye County, Nev.

TIEN SHAN: mountains, Turkestan. (Not Thian Shan, Tian-Shan, Thian-Shan, nor T'ien Shan.)*

TIJERAS: village, Las Animas County, Colo. (Not Tijera nor Tijeres.)

TONGUE: creek, Delta County, Colo. (Not West Fork Winnemucca nor Forked Tongue.)

TROUT: lake, San Miguel County, Colo. (Not San Miguel.)

TURKEY: creek, a left-hand branch of Arkansas river, Pueblo County, Colo. (Not Big Turkey.)

WEST ELK: creek, a right-hand branch of Taylor river, Gunnison County, Colo. (Not Illinois.)

WHEELBARROW: peak, the highest summit of Belted Range, Nye County, Nev.

YUCCA: mountain, west of Forty-Mile Canyon, Nye County, Nev. (Not Joshua.)

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* Reversal of former decision.

ALASKA.

Barwell: island, in Resurrection Bay. (Not Cape.)
Bowser: creek, flowing into Cook Inlet.
Brown: creek, flowing into Cook Inlet.
Bruin: bay, Cook Inlet. (Not Bear.)
Caines Head: cape, Resurrection Bay.
Cheval: island, in Resurrection Bay. (Not Horse.)
Culross: island, in Prince William Sound. (Not Grant.)
Douglas: mountain, near Cape Douglas.
Dry: bay, Cook Inlet.
East Glacier: creek, flowing into Cook Inlet.
Gompertz: channel, between East Foreland, and North Foreland, Cook Inlet.
Hive: island, in Resurrection Bay. (Not Guard nor Sugar Loaf.)
Iliamna: bay, lake, town, and volcano.
Iniskin: bay, in North shore Kamishak Bay, west shore Cook Inlet. (Not Innerskin, Inniskin, Inerskin, Initskin, Inischen, nor Enochkin.)
Lowell: point, Resurrection Bay.
Middle Glacier: creek, flowing into Cook Inlet.
Oil: bay, Cook Inlet.
Pilot: rock, in Resurrection Bay. (Not Light House.)
Renard: island, in Resurrection Bay. (Not Lowell nor Fox.)
Rugged: island, in Resurrection Bay. (Not Baker.)
Salmo: rock, off Mouth of Kenai River.
Seward: town. Resurrection Bay.
Susitna: river (tributary from the north to Cook Inlet), mountain and village. (Not Sushitna nor Sushetna.)
Thumb: cove, Resurrection Bay. (Not Dickinson.)
Tuxedni: harbor, Cook Inlet. (Region immediately south of Chisnik Island.) (Not Snug.)
Ursus: cove, Cook Inlet. (Not Bear.)
West Glacier: creek, flowing into Cook Inlet.

NEW MAPS.

AFRICA.

ABYSSINIA.—Sketch Map to Illustrate the Journey of Herbert Weld Blundell in the Abai Basin, 1905. Scale, 1:1,000,000, or 15.7 statute miles to an inch. Geog. Jour., London, June, 1906.

The Abai is the upper part of the Blue Nile. The explorer travelled, particularly in the southern part of the basin, from near the point where the river turns west to the place where it leaves Abyssinia. The map is constructed from a prismatic compass traverse supplemented by plane-table sketches, the distances being obtained from the rate of travel.

AFRICA.—Jährliche Regenmengen auf dem Festlande von Afrika. Scale, 1:25,000,000, or 394.5 statute miles to an inch. By G. Fraunberger. *Pet. Mitt.,* Vol. 52, No. 4, 1906, Gotha.

Illustrates Dr. Fraunberger's paper on annual precipitation in Africa. This is one of the maps which, some day, will have historic interest as pioneer attempts to record various classes of phenomena relating to the continent. Dr. Fraunberger uses eleven colours to show the distribution of precipitation as recorded in the reports of the rain stations, many of which have been established in parts of Africa, while others are scattered over wide areas. Such stations now exist, for example, at Basoko, New Antwerp, Stanley Falls, Bolobo, Brazzaville, Leopoldville, Matadi, Boma, and Banana on the banks of the Congo. Insets give the same information on a larger scale for the Cameroons coast and the Usambara district in German East Africa.

Anglo-Egyptian Sudan.—Provisional Map of Khartoum City, Khartoum North, and Omdurman. Scale, 1:253,440, or 4 statute miles to an inch. Compiled for the use of the Khartoum Mudiria by Lieut.-Col. E. A. Stanton, Governor Khartoum Province. Two sheets.

Col. Stanton has compiled this well-drawn and excellently-printed map from various sources. The scale is sufficiently large to show the important buildings, markets, ruins, and other features of Khartum and Omdurman, with the plots of cultivated land, the sand dunes, and other topographic features. It is the first map to make fully intelligible all the information now accessible with regard to this important centre. It supplies a need, and it will be worth while to introduce its most essential features on some of the best atlas sheets.

Anglo-Egyptian Sudan.—Stations at which Rainfall was measured in 1905 in the Basin of the Upper Nile. Scale, 1:7,500,000, or 118.3 statute miles to an inch. Survey Department, Cairo, 1906.

Accompanies the Report on "The Rains of the Nile Basin in 1905" by Captain H. G. Lyons. The map distinguishes between stations where rainfall was measured and those where only rainy days were recorded. Rain records were kept last year at 62 stations in the Nile basin and 14 in British East Africa. The latter are not in the Nile Basin, but are important to show the variation of the rainfall in different areas.

Egypt.—Topographical Map of Giza Province. Scale, 1:10,000, or 0.1 statute mile to an inch. 49 sheets. Cairo, Survey Department, 1905.

This map, finely drawn and engraved, is on so large a scale that an extraordinary amount of detail is inserted. Forty-nine sheets of the map have thus far been printed on this scale. Much of the nomenclature is given both in English and Arabic.

Kamerun.—Provisorische Karte der Gebirgslandschaften des Militärbezirkes Fontem. Scale, 1:100,000, or 1.5 statute mile to an inch. By M. Moisel. *Mitt. v. Forschungsreisenden u. Gelehrten aus den Deutsch. Schutzgeb.* Vol 19, No. 1. Berlin, 1906.

This is a compilation of the surveys made in a district of West Kamerun by eleven German officers between 1897 and 1905. Routes are given and the drainage and relief, and the positions of towns, market-places, and many farms are shown.

Zululand.—Map of Zululand. Compiled from surveys by L. M. Altern, A. Hammer, and F. A. Middleton. Scale, 1:158,400, or 2.5 statute miles to an inch. 6 sheets. Surveyor General of Natal and Zululand, Pietermaritzburg.

This is the best map of Zululand yet produced, and is desirable material for improving the atlas maps of this part of South Africa. It will ultimately be supplanted by a more detailed survey, but meanwhile it presents much information not hitherto accessible. Hills are shown in brown form lines and the rest of the map is printed in black. Heights are in figures, and mission stations, kraals, offices of the magistrates, European houses, trigonometrical points, forts, telegraph lines, railroads, common roads, and much other information are clearly given. Some of the details are a little unusual. One place on a river is marked "trees thrown into water whereon natives pass." A "conspicuous sandslip," "remarkable square topped hill," tall trees," and "flagstaff fallen down" are among the sights along the ocean.

AMERICA.

Hydrographic Office Charts.

Pilot Chart of the North Pacific Ocean, July, 1906.

Pilot Chart of the North Atlantic Ocean, June, 1906.

The reverse shows the route followed by the U. S. Dry Dock *Dewey* on her passage, under tow, from Chesapeake Bay as far towards her destination (Luzon) as the Suez Canal; also a list of the 35 U. S. naval wireless stations in working order on the Atlantic and Pacific Coasts and their islands, and the 11 wireless stations of the Canadian Government on the Atlantic Coast and islands. These stations are shown on the face of the pilot charts.

New Jersey.—Topographic Map of New Jersey. Scale, 2,000 feet to an inch. (Somerville, Pluckemin, and New Brunswick Sheets.) Contour interval in level country, 10 feet; in hilly country, 20 feet. Geological Survey of New Jersey, Trenton, 1905.

Further sheets of the new map of the State described in the Bulletin, p. 499, 1905. The maps are the result of recent surveys, and contain practically all the features of the one-inch maps, with much new material.

Argentina.—Plan de la Ville de Buenos Ayres. Scale, 1:28,000, or 0.45 statute mile to an inch. By the Department of Public Works. Buenos Aires, 1904.

A photographic reduction of a large municipal map. Notable buildings and places are indicated by figures referring to explanatory text. The map shows the entire street plan and differentiates those streets which have not yet been opened. It illustrates the volume "Recensement Général de la Ville de Buénos-Ayres."

Canada.—Verbreitung der deutschen Abkommenschaft im Kanadischen Bunde 1901. Scale, 1:7,500,000, or 118.3 statute miles to an inch. By Dr. Paul Langhans. With insets of southern Manitoba and Ontario, on a scale of 1:3,700,000, or 58.3 statute miles to an inch. *Deutsche Erde,* No. 2, Gotha, 1906.

Shows in colours the percentage of German residents per 100 inhabitants in each district of Canada, based upon the Fourth Census, 1901. Illustrates an article by Prof. A. Oppel on "Das Deutschtum in Kanada."

ASIA.

Dutch East Indies.—Schetskaart van een deel van het eiland Seran. Scale, 1:500,000, or 7.8 statute miles to an inch. By F. J. P. Sachse. *Tijdschrift* of the Royal Netherlands Geographical Society, Vol. 23, No. 3, Amsterdam, 1906.

Shows with considerable detail the recent surveys of the western and most of the northern sides of Ceram. Upon these surveys are based the change in the form of this island as it appears in the ninth edition of Stieler's Hand-Atlas. The boundary between the north and south administrative districts mainly follows the water-parting between the north and south flowing streams.

Japan.—Carte de l'Empire du Japon. Scale, 1:3,000,000, or 47.3 statute miles to an inch. Imperial Press, Tokio, 1905.

Illustrates the annual *Report* of the Minister of Finance on Japan's financial and economic condition. It fully shows communications by land and sea, and gives—what is rare on atlas sheets of Japan—the headquarters of the army divisions and the military ports.

JAPAN.—Mission Map of Japan. Scale, 1:1,250,000, or 19.7 statute miles to an inch. Compiled by H. M. Landis. Methodist Publishing House, Tokio, 1904. (Price 75c., postage 9c.)

An excellent map of Japan based upon Government surveys and showing the chief geographical features—roads, sea routes, etc.—in addition to a large amount of information about missions, chiefly their distribution and the populations of the large number of centres which they occupy.

SINGAPORE.—Map of the Island of Singapore and its Dependencies. Scale, 1:63,360, or 1 statute mile to an inch. Colonial Engineer's Office, Singapore, 1904.

The scale of this map in colours is large enough to admit of much detail, such as the various kinds of roads, railways in operation or proposed, forest reserves, altitudes above sea-level, and other data.

PALESTINE.—Stanford's New Orograpical Map of Palestine. Compiled under the direction of H. J. Mackinder. Scale, 1:253,440, or 4 statute miles to an inch. Edward Stanford, London, 1906. (Price, coloured sheets, 16s.; mounted on rollers and varnished, 20s.)

This map is equal to the best of the previous works in this series. Thirteen shades of brown show heights from sea-level to 9,000 feet above it, three shades of olive green show land below sea-level, and three shades of blue indicate various depths of the sea. Confusion is avoided by thus using one colour only to show one kind of facts. A distinction is made between perennial streams and merely occasional torrents. This map, while especially prepared for schools, is adequate for most reference purposes, and is one of the best generalisations yet made from the surveys of the Palestine Exploration Fund and other sources of information. Precise data fail only in the east and especially toward the southeast, where the broad washes of colour give facts only with approximate truth. Asia will soon appear in this orographical series, and North America is now in preparation.

EUROPE.

SCOTLAND.—Map of Kingussie District. Scale, 2 miles to an inch. *Scot. Geog. Mag.*, Edinburgh, June, 1906.

Illustrates a paper by Miss Newbigin on this part of the Scottish Highlands. Altitudes shown by four brown tints and white.

SWITZERLAND.—Spezialkarte des Exkursionsgebietes von Bern. Scale, 1:75,000, or 1:18 statute mile to an inch. By H. Kümmerly and Frey. Geographischer Kartenverlag, Bern, 1905. (Price, paper 3 frs., linen 4 frs.)

One of the excellent maps which this Swiss firm is constantly producing for tourists. The topographic relief is shown by a combination of contours (100-feet interval) and shading the light coming from the northwest so that the south, southeast, and east slopes of the mountains are in shadow. The large scale permits the great variety of information required by the tourist to be plainly indicated by symbols. It would add interest to such maps if the valley as well as the summit elevations were given in figures, so that the differences in height might be determined more quickly than by counting the contour lines.

SWITZERLAND.—Carte des Nivellements de Précision de la Suisse. Scale, 1:1,000,000, or 15.7 statute miles to an inch. Swiss Geodetic Commission, Bern, 1905.

Shows the lines of levelling carried out between 1865 and 1903, and the work done by each of the branches of the service engaged in it. The map illustrates a report on this work of the Department of the Topographic Survey in the Swiss Geodetic Commission.

ATLASES.

ANDREES ALLGEMEINER HANDATLAS.—In 139 Haupt und 161 Nebenkarten, nebst vollständigem alphabetischem Namenverzeichniss von etwa 240,000 Namen. Fünfte, völlig neubearbeitete und vermehrte Auflage. (Lieferungen 31-36.) Herausgegeben von A. Scobel. Velhagen & Klasing, Leipzig, 1906. (Price of complete work, M. 28.)

This new edition is rapidly approaching completion. Among the maps in these six parts, the "Südpolargebiete," on the scale of 1:30,000,000, is the largest and one of the best Hand-Atlas Charts of the Antarctic yet published. Five colours are used to denote sea depths. Positions of the great ice wall extending eastward from Erebus Island are given according to Borchgrevink in 1900 and Scott in 1902. "British Nordamerika und Alaska," on a scale 1:12,500,000, shows as much detail as may be clearly presented on this scale. It includes the proposed new Canadian trans-continental line with its branch to the Klondike; Alaska is an excellent compilation of the latest data. In Labrador, the Naskaupi, Northwest, and George Rivers are laid down as though they were completely explored, while on the sheet of the Canadian Geological Survey they are shown in broken lines, and the latest information, soon to be published, will make important changes in the mapping of these rivers. "Südwestliche Vereinigte Staaten und Nördliches Mexico," one of the four sheets of the United States, on a scale 1:5,000,000, shows that this map of our country will be very serviceable to American purchasers, for a great deal of detail is given with the utmost clearness, though the scale might with advantage have been larger. As the railroads are printed in red, the eye follows them with the utmost ease. "Mitteleuropa, Physische Übersicht," scale 1:3,500,000, is a fine generalization of the topographic forms of the European mainland between the Baltic and the Danube, the English Channel, and the Carpathians. This Atlas has always excelled in its African maps, and pp. 159-176 in this edition are devoted to that continent. "Nordwestliches Afrika," on a scale of 1:10,000,000, gives all details which the scale permits, and shows how much has been done in the past few years, especially by Germany and France, to collect new facts for the maps. The sheet of "Südbayern, Vorarlberg, Tirol und Salzburg" is so dark that many of the names are not easily read.

ATLAS OF THE WORLD'S COMMERCE. COMPILED FROM THE LATEST OFFICIAL RETURNS AT THE EDINBURGH GEOGRAPHICAL INSTITUTE. EDITED BY J. G. BARTHOLOMEW. (Part 5.) George Newnes, London, and Frederick Warne & Co., New York. (Price per Part, 25 cents.)

Two map sheets are given to wool and coal—4 wool and 5 coal maps. The map showing the distribution of wool growing distinguishes between areas producing British wools, cross-bred wools, fine wools (merino), coarse wools, goat's wool, and camel hair. The inset maps show the distribution of sheep, with density to the square mile, in the British Islands, the United States, and Cape

Colony. The letterpress and diagrams on the back of the sheet relate chiefly to the industry in the United Kingdom. The coal map shows in red the coal districts in all lands. The United States inset shows coal distribution on a larger scale and distinguishes between anthracite, bituminous, and lignite. Other insets show the coal districts of the United Kingdom and the export ports, the coal districts of Germany, Belgium, and France, and the importing countries, chief of which are Canada, Scandinavia, France, and Australia. The back of the sheet presents a general summary of steel and coal, with diagrams. The description of the "commodities of commerce" is continued from "Gutta-percha" to "Leather." This fine work maintains its exceptional interest and value.

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BOOK NOTICES.

Das europäische Russland. Eine Studie zur Geographie des Menschen. Von Alfred Hettner. Leipzig und Berlin, B. C. Teubner, 1905.

This is an enlarged and revised edition of a series of articles on Russia in Europe published by the author in the *Geographische Zeitschrift.* Its purpose is to expose the geographic foundations of the Russian people, state, and civilization, which, after a chapter on the physiography of the country of a more introductory character, are studied under the headings of the historical development and its results, the nations, the religions, the state, the settlement and population, transportation, industries, material and intellectual civilization, of the empire. As a study in anthropogeography it becomes of especial value through the discretion of the author in not trying to reduce every possible phenomenon to a simple geographic formula. Not many publications of this kind draw so clearly the line between geographic and non-geographic influences, and the way in which the author shows how the two have in different times co-operated with, or counterbalanced, each other constitutes one of the most interesting features of the book and gives it a methodical value just as great as its informational one. The keynote of the author's presentation is the fundamental difference between the Empire in the Russian lowland and the states of western Europe, together with their daughter states in the New World. As long ago as the 17th century this disparity caused Leibnitz to place Russia with Persia and Abyssinia, and it forms between Russia and western Europe a barrier larger than that between the latter and the other continents to this day. Russia's seclusion from the Atlantic the oriental origin of her religion, the Asiatic character of her government—everything contributed to her having nothing in common with the West and its civilization. When the latter was at last artificially introduced it remained a mere superficial varnish of the upper classes, which only served to create a gap between them and the common people. Neither half knew how the other half lived; and their present needs are vitally different. The upper classes are modern men and women, whose ideals and capacities are equal to those of the most progressive nations; while the eighty per cent. of peasant population can be compared only to the corresponding classes of Western Europe in the Middle Ages, before the peasant rebellions of the Age of the Reformation. Their immediate needs wil be remedied by better methods of government and a just distribution of the land; and those of the future by education, which will enable them ultimately to acquire also political privileges. In this and other respects, the book is an admirable example of scientific geographical study which "neither praises nor condemns, but tries to understand." M. K. G.

Immanuel Kant, Physische Geographie. Zweite Auflage. **Herausgegeben von Paul Gedan.** Philosophische Bibliothek, Band 51. Leipzig, Dürrsche Buchhandlung, 1905. (Price, M. 2.80.)

Kant at Königsberg and Gatterer at Göttingen were the first scholars who introduced geography as a science into the curriculum of the university, and for this reason Kant's Physical Geography will never lose its value as one of the fundamental documents of our science. This, and the fact that the book is based, not on the original manuscript of the author, but only on lecture notes of some of his hearers, has caused a considerable number of republications of the book by various scholars even after it had long lost its value as a source of information. This edition by Dr. Gedan is the latest of them, and shows a considerable number of corrections which bear testimony of how carefully every means of getting as near as possible to the author's true meaning has been utilized. In an introductory sketch the editor shows that the author of the Critique of Pure Reason was far from treating the subject only as a hobby or side-interest. He announced this course of lectures for no less than 47 semesters and read it in 29. He laid especial emphasis on the educational value of geography, emphasizing the need of a scientific treatment of the subject which should substitute careful examination of the facts for the credulous acceptance of marvellous tales, and he contributed to it himself by original investigations of geological, meteorological, and anthropological problems. In 1756, for instance, he discovered the law of the deviation of the trade winds, independent of Hadley; in 1754 he claimed the necessity of long geological periods in opposition to the theory of cataclysms; and in 1798, in his Anthropology, demanded "a natural history .... which would show the changes of the creatures of the earth being due to migration and subsequent deviation from a few original types," thus anticipating the ideals of Lyell, Darwin, and Moritz Wagner. In the plan of the book it is interesting that the author's conception of physical geography comprises physical geography, strictly speaking, as well as a short systematic zoology, botany, mineralogy, and regional geography of the countries. He evidently understood the term, as even some modern scientists do, as the scientific treatment of natural phenomena in contrast with the merely descriptive treatment. Beside this "physical geography" proper, he places as independent but correlated subjects mathematical geography, "moral" geography (the study of the ethics of the nations upon a geographic basis), political geography, commercial geography, and "religious" geography (the study of religions from a geographic point of view). Thus he approaches Humboldt in the universal conception of the subject, and it is certainly one of the most felicitous circumstances in the history of our science that, when his metaphysical work began to absorb him so as to put a stop to further researches in the concrete sciences, Humboldt was all ready to take up the work where Kant had left it. M. K. G.

La Guyane Inconnue. Voyage à l'Intérieur de la Guyane Française. Par Albert Bordeaux. Paris, Librairie Plon, 1906. iv–288. (Price, 3.50 fr.)

A tiny map, barely a sketch of the three Guianas—English, Dutch, and French—terminates a well-printed octavo volume. Its modest size is in harmony with the unpretentiousness of the author, and yet the little book has very substantial merits. It is *very* entertaining, has an abundance of local colour, and contains much solid information, mixed, of course, with a few glaring errors of small importance. Mr. Bordeaux, for instance, still believes that the porcupine may detach its quills at will; he is convinced that the condor exists in Guiana, that the tiger or jaguar also bears the name of puma, and the like. We may well pass over such mistakes if we take into account that he has not made the animals of tropical forests his special study, and hence relied upon information from the people who, as everywhere else, are not always the most reliable source. In regard to the tapir, that pachyderm must be much taller in Guiana than in other places, since Mr. Bordeaux, who saw and hunted it, compares it in size with a small horse or with a cow.

Mr. Bordeaux is a mining engineer, and one who has had much practical experience in many parts of the world; Chapter VIII (pp. 107 to 123) gives evidence of it. He knows prospectors as well as promoters and capitalists. But he is, above all, a good observer and an intense lover of nature. Such must be the case, indeed; for he could not otherwise be enraptured with several months of life in dusky forests where nature is an impediment, a constant threat to man. The forests of Guiana teem with life, and in this manner distinguish themselves from the timbered wildernesses of the upper Amazonian region, above the level where the great fluvial arteries begin to furrow the basin of Brazil and Bolivia. To Mr. Bordeaux every branch of organic life appeals, and his descriptions are candid, spontaneously eloquent. He leads us to the gold placers of interior Guiana; we feel with him the inconveniences and serious drawbacks of daily and nightly toil, in a climate where torrential rain is the rule nearly all the year through. But as he never complains and always finds mitigating circumstances for the worst of plights, never tries to make of himself a hero or a victim, our reading of his story is cheering, however uncomfortable the conditions may have been.

His stay in the placers has enabled him to furnish vivid pictures of these establishments, so little known to the outer world. Life in them is not altogether enticing, owing to climatological difficulties; but as the work is performed voluntarily, and for the sake of employment, nobody has a right to complain. He describes the methods, their advantages and drawbacks. We gather that the washings have produced thus far a sum of nearly fifty millions of dollars, all told. The difficulties of transit and transportation and the consequent cost of living are most serious impediments. The production has varied considerably from year to year, the first year yielding more than any of the succeeding ones.

Most instructive are his, tactfully short, remarks on the condition of the exiles, the number of whom he estimates at about six thousand. Those people appear to be, in fact, the favourites of the Government at Cayenne. They work less than others, and are almost excused from any sort of punishment. They have cost, since 1854, sixty millions of francs at least, and their work has hardly produced anything. It is well to treasure the following passages (p. 209): "When a routine lasts fifty or sixty years, and is tied to the changing influence of a régime, France suffers on her part; there is neither strength nor time to perform durable work." He suggests that the criminals be sent elsewhere, "to the islands of Kerguelen, for instance, south of Africa, where, it is said, there are only seals and a Consul. The climate there is excellent."

These criticisms on the system of deportation and the ridiculous petting of the deported by the French Republic are but the prelude to a concise exposition of the real value of Guiana through its numerous natural resources, which the author cursorily enumerates, and the use which, under the system of government, is made of them. The impression caused by the contrast recalls, in the most striking manner, the conduct of France towards her former colony of Canada. The same neglect, the same abandonment of the most essential interests. Guiana, one of the richest (naturally) regions of the earth, is made to depend, not even on the mother-country, but on its neighbours, and especially on the United States, for most commodities of life. With the exception of gold-dust, it exports almost nothing. France, which consumes annually six to seven hundred tons of rubber, receives, of that amount, only a few tons from its colony of Cayenne, where rubber and the *balata* grow well. Cotton is abandoned, coffee and sugar have to be imported, and the duties which the French Government exacts on all such necessaries of life are exorbitant. The number of souls (deported not included) in Guiana is stated at about thirty-five thousand, and the smallness of this number (in proportion to the territory) is generally attributed to insalubrity. There is no doubt that the coast is not healthy; but if we can trust the figures given by Mr. Bordeaux, mortality in Guiana is not by any means as great as in Senegal, in Martinique, and in Guadeloupe. In the former region it is six and seventeen hundredths per cent., on the islands from eight to nine, in Guiana two and a half per cent. Statistics are not an absolutely sure criterion; still, with margin enough for error, the figures are in favour of Guiana.

Recent events in Guadeloupe seem to indicate a state of things in that island similar to what Mr. Bordeaux reports of Guiana. A. F. B.

The Log of a Sea Angler. Sport and Adventures in Many Seas with Spear and Rod. By Charles Frederick Holder. x and 385 pp. and Index. Houghton, Mifflin and Company, Boston, 1906.

Mr. Holder has long been known as a writer on natural history, and especially on zoological topics. Much of the sea-angling experience recorded in this volume was obtained during the years when the author was one of a party of scientific men who were studying the growth and development of coral reefs off the coasts of Florida and sending collections of corals, fish, shells, and other specimens to the Smithsonian and other institutions. These researches resulted in new discoveries regarding the growth of corals indigenous to the Florida reef; and there was plenty of time, too, for fishing exploits in the summer months, the best time for the sport, though the increasing heat drives most northern anglers home before the finest part of the season begins. Mr. Holder knows how to write for entertainment as well as edification, and his twenty-four chapters on many kinds of sea-game, including the man-eating shark and the Spanish mackerel, afford many vivid glimpses of this kind of diversion. It is agreeable to hear from him that the old dictum is still endorsed, that no gentleman will catch more fish than he knows will be utilized. While his Florida experiences supply the larger part of his reminiscences, he has drawn, also, upon other localities from Maine to California. He says that the splendid-hued Spanish mackerel of the Mexican Gulf "is a gamy creature of most exasperating habit," whose sudden and fitful appearance off the coast always causes great excitement among the native fishermen. A short chapter is given to this fish, which, strangely enough, does not figure in the excellent index.

Down in Porto Rico. By George Milton Fowles. 163 pp. 17 Illustrations. Eaton & Mains, New York, 1906. (Price, 75c.)

Perhaps Mr. Fowles is optimistic, but he certainly gives many reasons for his firm faith that Porto Rico is on the highway to attain success in her efforts to become "a worthy member of the sisterhood of States." He gives in his book the results of first-hand information obtained by careful investigation, during a year on the island spent in studying the home life, institutions, and condition of the people. The book opens with a geographical description and historical sketch of the island, and then follow chapters on the homes of the people, their characteristics and customs, their education under the Spanish régime and, later, under our military and civil government, their morals and religion, the present industrial and political situation, and a summary of the results of the author's studies.

Mr. Fowles does not minimize the fact that there are causes of political discontent and various other difficulties in the way of Porto Rico's advancement; but he sees abundant evidence that the islanders are getting a start in the right direction. Already 60,000 children are receiving a common-school education, and present misunderstandings will disappear when the rising generation, understanding our institutions better, comes on the stage. The union of Church and State proved disastrous, but Porto Rico is now released from ecclesiastical bondage. Many thousands of the men and women have lived together though not legally united, but a great impetus has been given to the establishment of legal homes. Economic conditions are improving. This is one of the best books that has been written for all who wish to know more about Porto Rican conditions. The half-tone photographs are excellent, but the map is poor.

Archives Marocaines. Publication de la Mission Scientifique du Maroc. Par Maurice Besnier. 65 pp. and Map. E. Leroux, Paris, 1906. (Price, 2 fr.)

We have the French chiefly to thank for the additions that have been made to our knowledge of Morocco in recent years. This book is the result of diligent search among the writings of early geographers or of modern authorities who have written about them to find what the ancients knew of Morocco. The earliest allusions to Morocco seem to be found in Homer, whose island of the nymph Calypso is supposed to be the little island of Perejil in the Strait of Gibraltar. The author reviews the ancient documents relating to Morocco, taking up first those that describe the coasts and then those treating of the interior. Authors and documents later than the third century of the Christian era add scarcely anything to what was known by earlier writers. The incomplete and fragmentary information that the ancients transmitted to us is then discussed. It is found to be impossible to locate many points mentioned by the early geographers, but the author believes that future archæological research in Morocco will throw light on many questions.

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THE CLASSIFICATION OF CLIMATES: II.

BY

ROBERT DeC. WARD,
Harvard University.

SYNOPSIS.

Supan's Climatic Provinces.—Köppen's Classification of Climates.—Hult's Classification of Climates.—Ravenstein's Hygrothermal Types.—Classification of Rainfall Systems.—Summary and Conclusions.

Supan's Climatic Provinces.—The ordinary classification into continental, marine, and mountain climates is too general. Some scheme of classification is needed in which the geographical factor plays an important part, and which recognizes the types of climate, possessing common characteristics of temperature, rainfall, and winds, which occur over areas having similar topographic conditions. A fairly simple scheme of this kind has been suggested by Supan, who recognizes thirty-five so-called climatic provinces,* but any such rigid subdivision is obviously susceptible of almost infinite modification. Twenty-one of these provinces are in the Eastern hemisphere, including Polynesia; twelve are in the Western, and two in the polar zones. The descriptions of these provinces are as follows:†

1. Arctic Province. This coincides with the north polar cold cap, the area wherein the mean temperature of the warmest summer month is never over 50° F., and within which trees do not grow.

2. West European Province. Mild winters, owing to influence of the westerly winds and Gulf Stream. Yearly temperature range

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* A. Supan: *Grundzüge der physischen Erdkunde*, 3d Ed., Leipzig, 1903, 211–214.

† Free translation of original, following Bartholomew's *Atlas of Meteorology*, p. 7.

under 59° F. (15° C.). Plentiful rainfall, fairly well distributed throughout the year, but varying in quantity owing to great diversity of land contours. The climatic conditions often vary in short distances, and hence the region can be divided into many subdivisions.

3. East European Province. Here the evidences of a land climate begin to be observed; but as most of the region is a plain, differences depend mainly on latitude. The rainfall is smaller than in Province 2, and gradually diminishes towards the southeast, and has a marked summer maximum.

4. West Siberian Province. This is separated from 3 by the limit of the positive annual isanomalous lines, which practically coincides with the Urals. The characteristic peculiarities of 3 are found here greatly emphasized, and the greater variability of temperature is to be noted.

5. East Siberian Province. A gradual rising of the ground is found east of the Yenisei, with low plains only along the rivers. The winter cold pole is here, and the yearly range of temperature is a maximum. As a rule, the rainfall is low.

6. Kamchatkan Province. The sea diminishes the temperature extremes noted in Province 5, and much rain falls.

7. Sino-Japanese Province. On the continent relatively well-marked winter cold, and strong periodical rains. In Japan these peculiarities are less extreme.

8. Asiatic Mountain and Plateau Province. This includes all the lofty plateaux bounded by mountain ranges, which shield it on every side, and so render it very dry. The great height makes the winter temperature severe; but the summer heat is great, owing to the continental position. The daily as well as the yearly range of temperature is very marked.

9. Aral Province. Dry low-lying plain, with the greatest rainfall in the north in summer, and in the south in winter. The plains of western Turkestan have severe winters and very hot summers.

10. Indus Province. A plain remarkable for great dryness and heat.

11. Mediterranean Province. Very varied in climate, owing to its great irregularity of outline, both horizontal and vertical. Mild, except on high plateaux. Winter rains.

12. Saharan Province. Reaches to Mesopotamia. Region of dry north winds, and probably the one receiving least rain. Its continental position and lack of vegetation increase the heat of

summer extraordinarily; both annual and daily ranges of temperature are considerable.

13. Tropical African Province. Owing to the height of the central plateau the heat is less intense, but it is very great on the narrow coastal plains. Tropical rains decreasing towards the west.

14. Kalahari Province. Includes all the almost rainless region of Southwest Africa.

15. Cape Province. Sub-tropical.

16. Indo-Australian Monsoon Province. Strong periodical rains are brought with the southwest and northwest monsoons, except at a few places in the archipelago. The temperature is fairly uniform, despite the great extent of the province, and the yearly range is very small.

17. Inner Australian Province. With great extremes of temperature. Irregular and rare rains.

18. Southwest Australian Province. Sub-tropical.

19. East Australian Province. It extends to the water-parting and includes the southeast coast and Tasmania. Plentiful and fairly regular rains. Moderate range of temperature.

20. New Zealand Province. Probably includes the small neighbouring islands. Mild climate, with fairly regular rains.

21. Tropical Polynesian Province. Tropical climate, ameliorated by the ocean, so that mild summer weather prevails throughout the year. On the loftier islands the rain is abundant, and has a tropical periodicity.

22. Hawaiian Province. Also a mild climate, but with sub-tropical rains.

23. Hudson (North Canadian) Province. Great extremes of temperature and little precipitation.

24. Northwest American Coastal Province. Mild, equable, rainy climate.

25. Californian Province. Relatively cool, especially in summer. Marked sub-tropical rainy seasons.

26. North American Mountain and Plateau Province. Great yearly and daily ranges. Dry.

27. Atlantic (East North American) Province. Great contrast in temperature conditions of north and south in winter. Extreme climate even on the coast. Plentiful rains, evenly distributed throughout the year. Great variability.

28. West Indian Province. This also includes the southern rim of North America. Equable temperature. Rain at all seasons, but with a marked summer maximum.

29. Tropical Cordilleran Province. On the interior plateau perpetual spring, owing to considerable height above sea-level. In Mexico and Central America marked zenithal rains; in South America more regular precipitation.

30. South American Tropical Province. Little that is certain is known about this province, which includes mountainous regions and plains, and ought, therefore, to possess considerable variety of climate.

31. Peruvian Province. This province extends as far south as 30° S., and so includes the northern part of Chile. Abnormally cool. Rainless.

32. North Chilian Province. Sub-tropical.

33. South Chilian Province. Equable temperatures, with cool summers. Extraordinarily rainy.

34. Pampa Province. Range of temperature fairly large, especially in the north. Rain not plentiful.

35. Antarctic Province. Resembles the Arctic, so far as can at present be determined, in winter cold, but differs in having a very low summer temperature and a very regular distribution of pressure and winds.

Fig. 1 shows the geographical distribution of these climatic provinces.*

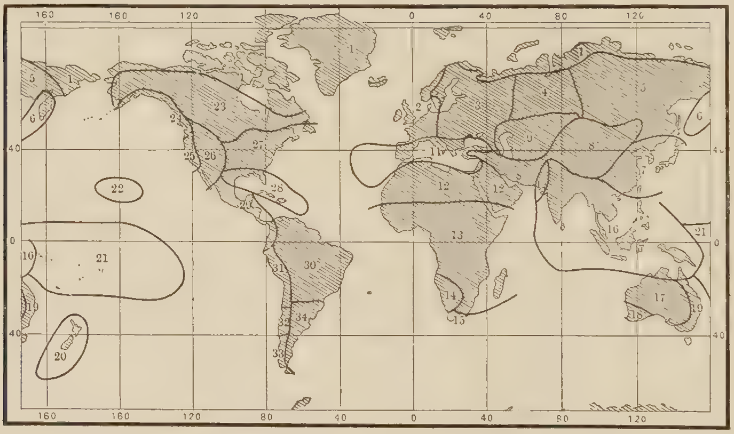

FIG. 1.—SUPAN'S CLIMATIC PROVINCES.

Köppen's Classification of Climates.†—An interesting classification of climates, from a botanical standpoint, is that proposed by

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* From A. Supan: *Grundzüge der physischen Erdkunde*, Leipzig, 1903. Pl. XIV. The provinces are numbered somewhat differently in the original map.

† W. Köppen: *Versuch einer Klassifikation der Klimate, vorzugsweise nach ihren Beziehungen zur Pflanzenwelt.* Hettner's Geogr. Zeitschr., VI, Nov.-Dec., 1900. Reprinted. Pp. 45 8°. Leipzig, Teubner. Abstr. in *Met. Zeitschr.*, XVIII, 1901, 106-120.

Köppen. This rests upon certain critical values of the temperature and rainfall of the warmest or coldest, or of the wettest and driest month. The plant classification proposed by A. de Candolle* in 1874, and later adopted by Drude,† is accepted. This is a division into five principal biological groups under the control of temperature and moisture, as follows:

A. *Megatherms:* plants which need continuously high temperature without much annual range, and also abundant moisture. There is no cool season; the temperature of the coolest month is over 64.5° (18° C.), and there is at least one month of heavy rain. When there are marked dry seasons the principal one comes in winter and spring. In parts of this belt there are two rainy seasons. In this belt are found the lofty tropical forests intertwined with vines and creepers—sago, betel, pepper, cacao, bread fruit, baobab, coffee, sugar cane, banana, ginger, and so on.

B. *Xerophytes:* plants which love dryness and need high temperatures, at least for a short season. These are found in tropical districts which have a long dry season, and in the steppes and deserts of the tropics and of the warmer parts of the temperate zones. They are adapted in various ways for life in a dry climate; they rest during the dry time, and, in extreme cases, where rain may not fall for years, they survive as seeds. The vegetation varies with the soil. In this group we find the date, mesquite, acacia, cactus, agave, and similar plants.

C. *Mesotherms:* need moderate heat (59°–68°) and a moderate amount of moisture; some require high summer temperatures; others shun low winter temperatures; others shun the dryness which often accompanies high summer temperatures. These plants inhabit latitudes between 22° and 45° N. or 40° S., as long as the moisture continues sufficient. There is a cool season—coldest month below 64.5° (18° C.)—and a hot summer,—warmest month over 72° (22° C.),—or a mild winter—coldest month over 43° (6° C.),—or both. The classic Mediterranean climate is found in this belt. The mesotherm belt contains the tea, maté, rice, cotton, magnolia, hickory, arbor vitæ, hemlock, wheat, corn, olive, fig, grape, heath, cinchona, etc.

D. *Mikrotherms:* need less heat, lower mean annual temperature, cooler and shorter summers, and colder winters. The warmest month is at least 50° (10° C.) and not over 72° (22° C.); the coldest is below 43° (6° C.), with at least an occasional snow-cover in winter and sufficient rainfall in the warmer season. Evergreen and deciduous forests, grains, and in the warmer portions fruit and corn are found.

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* A. de Candolle: Arch. Sci. Bibl. univ. de Genève, 1874.

† O. Drude: *Pflanzengeographie*, Stuttgart, 1890, p. 111.

E. *Hekistotherms:* plants of the Arctic zone, beyond the limits of tree growth and of the zone of scrubby Antarctic vegetation. These need the least heat. Mosses, lichens, and similar lowly forms are typical.

A simple scheme of distribution of these five groups of plants may first be developed with reference to an ideal continent, stretching from pole to pole, with oceans on both sides and without mountains (Fig. 2).* Here *a a* is the western and *b b* the eastern coast. The approximate latitudes are given at the margins. The groups of de Candolle's system are arranged as shown, if the xerophytes are limited to the deserts and steppes and if those woody plants of the megatherm and mesotherm zones which are adapted to a dry climate are included within these zones. The typical zonal arrangement is interrupted in latitudes 20° to 50° by the fact that the arid district of the xerophytes (B) is wedged in on the west coast between A and C. Farther east zone B broadens poleward, cuts through the middle of the mesotherm zone, and usually ends without reaching the east coast.

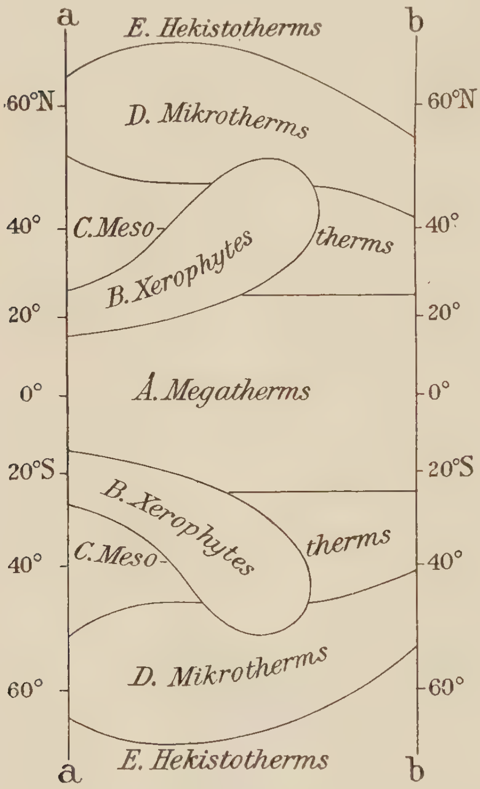

FIG. 2.—GENERAL DISTRIBUTION OF PLANT ZONES.

The five principal types are further subdivided until the whole number of climates reaches twenty-four. The special conditions which characterize each climate are carefully determined, and each sub-climate is named after one of its characteristic plants or animals; or after some distinctive meteorological phenomenon; or, again, after the general character of its vegetation. Fig. 3 gives the limits of the different sub-climates, and also the characteristic conditions of temperature and precipitation.* Fig. 4 gives the scheme of the sub-climates for the lowlands, with their names. Four climates which do not occur at sea-level are here lacking (C7, E3, E4, F).† The vertical distribution of these climates, much simplified, is shown in Fig. 5. The descent of the climatic strata from equator to higher latitudes is shown on the right for the con-

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* After Köppen, *ibid.*

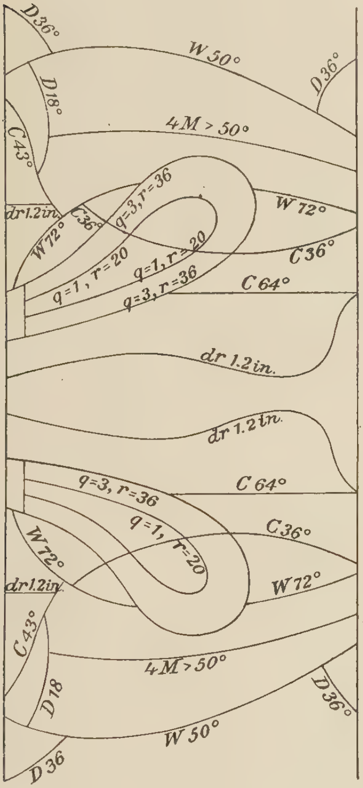

FIG. 3.—SCHEME OF CLIMATES AT SEA LEVEL.

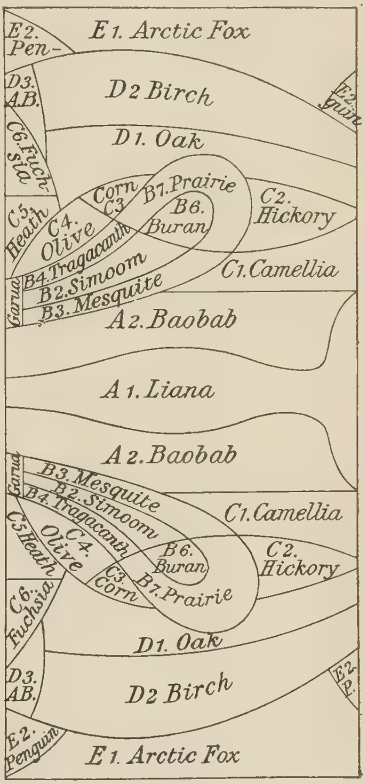

FIG. 4.—NAMES OF CLIMATES AT SEA LEVEL.

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* Figures are degrees Fahr. C = coldest month. W = warmest month. 4 M = 4 months. dr 1.2 in. = driest month rainfall 1.2 inches. D 18° and D 36° = difference between extreme months 18° and 36°. q = quotient obtained by dividing the amount of rainfall in the wettest month (in mm.) by the maximum vapour tension (in mm.) at the mean temperature of the same month, an expression which combines the effect of rainfall and evaporating power. r = rain probability of rainiest month.

† C7, High savanna climate; E3, Yak, or Pamir climate; E4, Chamois or High Alpine Climate; F, perpetual frost, without life.

tinental and on the left for the marine type, as far as about latitude 57°. Climates C1 to C4, and D1 and D2, have large temperature ranges, and are therefore lacking at the equator and on the ocean; while C5 to C7, and D3, have small ranges, and are not found on the continents of higher latitudes. The general control of pressure, winds and ocean currents over the climatic types is shown in the two following ideal diagrams, in which the two vertical lines indicate the west and east coasts of the ideal continent, and the area included reaches to the middle of the adjacent ideal oceans. The line 0°–0° is the equator (Figs. 6 and 7). The short arrows give the wind direction 500–1000 m. above the surface; calms are represented by the sign ⊙; the long broken arrows indicate the prevailing surface ocean currents. At *a a* there is a rise of cold water from beneath the surface of the ocean. The curving lines are sea-level isobars; the lower pressures are shaded. The letters and boundaries drawn in short slanting lines in Fig. 7 indicate the climatic districts of Fig. 2. Fig. 6 is similar to Fig. 7 as far as these climatic districts are concerned. Therefore the letters and boundaries are omitted. Plate I. shows the geographical distribution of the climatic types and subtypes.

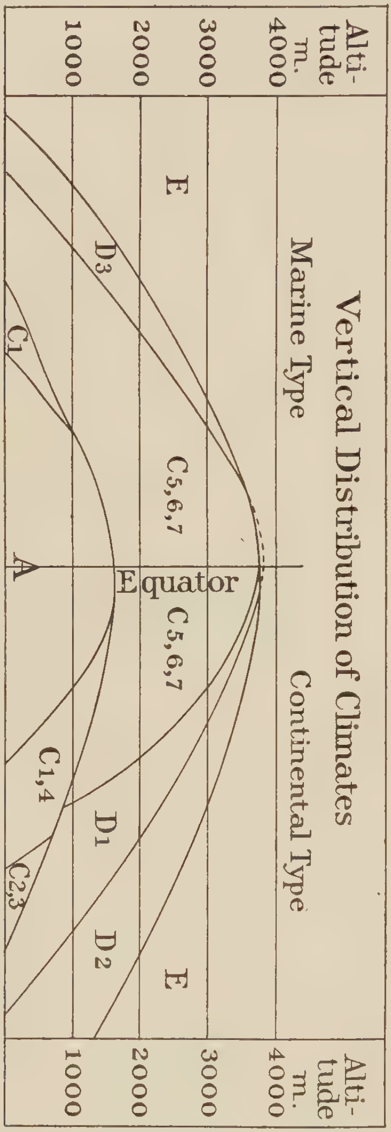

FIG. 5.—VERTICAL DISTRIBUTION OF CLIMATES.

*Hult's Classification of Climates.**—Another scheme of classifica-

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* R. Hult: *Jorden's Klimatområden. Försök till en indelning af Jordytan efter Klimatiska Grunder.* Vetenskap. Meddelanden af Geografiska Föreningen i Finland. I. 1892–93. Helsingfors, 1892–93, pp. 140–201. Chart XVI. Rev. *Met. Zeitschr.*, XII, 1895 (48)

tion, proposed by Hult, embraces three large divisions based upon differences in mean annual temperatures as follows: A. Cold districts, whose mean annual temperature (without reduction to sea-level) is below, or but slightly above, freezing. B. Temperate districts, with mean annual temperature of 32° to 68° F. C. Warm districts, with mean annual temperatures over 50°, and small annual range of temperature, the distribution of the rains and the changes in the winds being the chief characteristics of the seasons. These three main divisions are further subdivided on the basis of

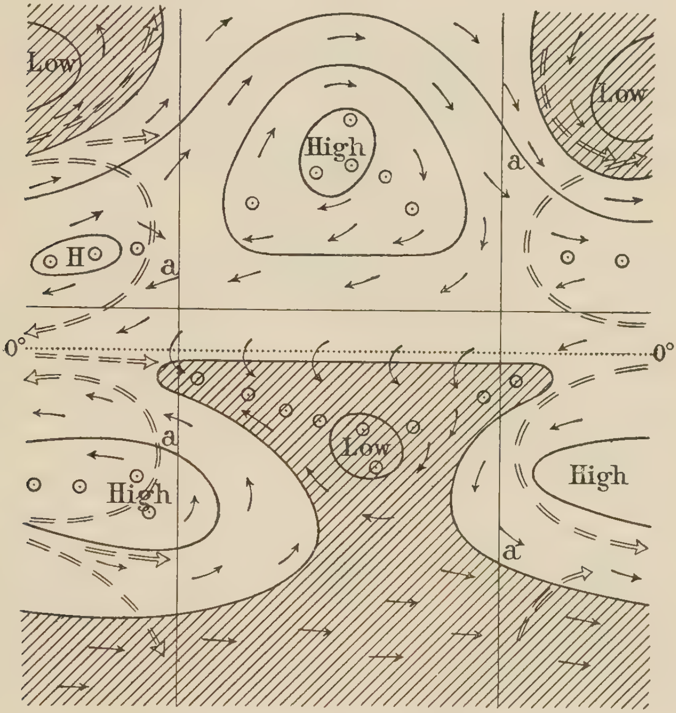

FIG. 6.—PRESSURE AND WINDS IN JANUARY.

their seasonal characteristics of temperature, of winds or of precipitation into nine smaller districts, including thirty-three different climatic kingdoms. These latter are again subdivided into one hundred and three smaller provinces. The subdivisions, omitting the smaller provinces, are as follows: A. α. Districts with cold summers (warmest month $\lesseqgtr$ 50°): I, Arctic; II, Antarctic; III, Tibet. β. Districts with warm summers: IV, Siberian; V, Hudson's Bay. B. α. Districts of prevailing westerly winds, with precipitation in all months and many cyclones: VI, Gulf Stream; VII, Kuro Siwo; VIII, South Pacific; IX, Andean. β. Districts with variable winds, winter rains and dry midsummers: X, Mediterranean; XI, Californian; XII, Southwest Australian; XIII, Benguela Current; XIV, Humboldt Current. γ. Districts with weak and irregular winds, summer rains, and with the principal dry season in winter: XV, Central Asiatic; XVI, Habesch; XVII, Rocky Mountain; XVIII, Blue Mountain; XIX, Orange Free State; XX, Pampa. C. α. Districts with one or two solstitial rainy seasons and with the trades weak or interrupted by local monsoons: XXI, African; XXII, Llanos; XXIII, Brazilian. β. Districts with normal trades and trade rains: XXIV, Madagascan; XXV, Caribbean; XXVI, Pacific. γ. Monsoon districts: XXVII, Indian; XXVIII, North Australian. δ. Districts with abundant rainfall in all months (doldrum rains): XXIX, East Indian; XXX, Suahelian; XXXI, Guinean; XXXII, Colombian; XXXIII, Selvan. The distribution of these types is shown in Plate II.*

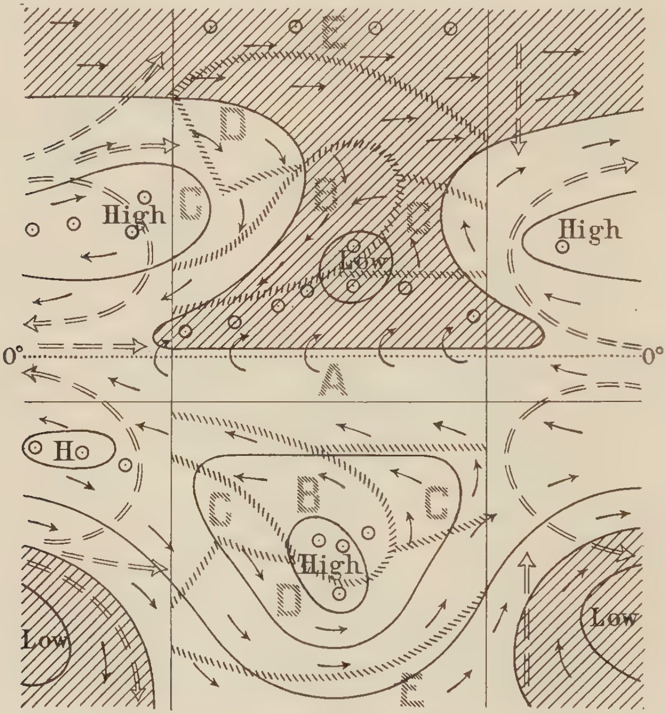

FIG. 7.—PRESSURE AND WINDS IN JULY.

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* From Hult, *vide supra*. On the chart here reproduced the smaller *provinces* are not shown.

Ravenstein's Hygrothermal Types.[*]—Recognizing the importance of relative humidity as a climatic factor in its influence upon life, upon agriculture and upon industry, and basing his grouping of climates upon certain relations between temperature and relative humidity, Ravenstein proposes a subdivision of the earth's surface into sixteen *hygrothermal* climatic types. The general characteristics and examples of these types are as follows:

1. Hot (73° and over) and very damp (humidity 81% or more): Batavia, Cameroons, Mombasa.
2. Hot and moderately damp (66–80%): Havana, Calcutta.
3. Hot and dry (51–65%): Bagdad, Lahore, Khartum.
4. Hot and very dry (50% or less): Disa, Wadi Halfa, Kuka.
5. Warm (58° to 72°) and very damp: Walvisch Bay, Arica.
6. Warm and moderately damp: Lisbon, Rome, Damascus, Tokio, New Orleans.
7. Warm and dry: Cairo, Algiers, Kimberley.
8. Warm and very dry: Mexico, Teheran.
9. Cool (33° to 57°) and very damp: Greenwich, Cochabamba.
10. Cool and moderately damp: Vienna, Melbourne, Toronto, Chicago.
11. Cool and dry: Tashkent, Simla, Cheyenne.
12. Cool and very dry: Yarkand, Denver.
13. Cold (32° or less) and very damp: Ben Nevis, Sagastyr, Godthaab.
14. Cold and moderately damp: Tomsk, Pike's Peak, Polaris House.
15. Cold and dry:
16. Cold and very dry: Pamir.

Classification of Rainfall Systems.—The seasonal occurrence of rainfall has suggested a classification of the rainfall systems of the world into types. While these schemes are useful in climatological study, they are hardly to be considered as classifications of climate. Mühry[†] gave a rigid scheme of rainfall types in six belts for each hemisphere, these belts being divided by latitude lines, and Köppen has prepared a useful map of the hyetal regions of the world based on the seasonal distribution of rainfall types.[‡]

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[*] E. G. Ravenstein: *The Geographic Distribution of Relative Humidity.* Rept. Brit. Ass. Adv. Sci., 1900, 817–818.

[†] A. Mühry: *Klimatographische Uebersicht der Erde*, Leipzig and Heidelberg, 1862, 741–744. Also: *Allgemeine geographische Meteorologie*, 1860, 145, and note 23, 199. Containing chart, as well as the scheme of rainfall types.

[‡] See *Atlas of Meteorology*, Plate 19.

Summary and Conclusions.—The broad classification of climates into the three general groups of marine, continental, and mountain, with the subordinate divisions of desert, littoral, and monsoon, is convenient for purposes of summarizing the interaction of the climatic elements under the controls of land, water, and altitude. But in any detailed study some scheme of classification is needed in which similar climates in different parts of the world are grouped together, and in which their geographic distribution receives particular consideration. It is obvious from the preceding paragraphs that an almost infinite number of classifications might be proposed; for we may take as the basis of subdivision either the special conditions of one climatic element, as, for example, the same mean annual temperature, or mean annual range of temperature, or the same rainfall, or rainy seasons, or humidity, and so on. Or again, similar conditions of the combination of two or more elements of climate may be made the basis of classification. Or we may take a botanical or a zoological basis. Of the classifications which have been proposed, special reference is here made to those of Supan, Köppen, and Hult. That of Supan, taken as a whole, gives a rational, simple, and satisfactory scheme of grouping, whose frequent use in climatic descriptions would tend toward system, simplicity, and facility of comparison. It emphasizes the essentials of each climate, and serves to impress these essentials upon the mind by means of the compact, well-considered verbal summary which is given in the case of each province described. Obviously, no classification of climates which is at all complete can approach the simplicity of the ordinary classification of the zones.

Köppen's admirable scheme of subdividing climates from the botanical point of view is distinctly rather for the use of students of plant geography than of general climatology. The present limits of the different climates in Köppen's map will doubtless need to be changed in several cases, as more detailed botanical studies throw further light on the geographical distribution of different plants, and no rigid delimitation of plant zones is ever satisfactory to everyone. But Köppen's classification has the great merit of recognizing the existing differences of climate between east and west coasts; and between coasts and interiors. The co-ordination of districts of vegetation and of climate, which this scheme so strikingly emphasizes, is a noteworthy fact in climatology.

Hult's classification is far too detailed, if all the smaller provinces are taken into account; but if only the larger kingdoms are considered, as in Plate II, the scheme is useful. It, however, possesses no advantages over that of Supan, which takes account of more typical characteristics of climate. Ravenstein's hygrothermal types rest upon unsatisfactory data, and regions of very different climatic conditions are grouped together because they happen to have the same mean annual temperature and relative humidity.

THE NORTH AMERICAN SHEETS OF STIELER'S HAND-ATLAS.

BY

FREDERICK J. H. MERRILL.

The sheets of Stieler's Hand-Atlas relating to North America command serious attention because of the high accuracy and authority of this work. They comprise a general map of North America, a general map of the United States, a six-sheet map of the United States, a two-sheet map of Canada, one of the West Indies and Central America, and one of Mexico. It is much to be regretted that no special sheet was prepared of Alaska, which promises so much in its mineral wealth.

The six-sheet map of the United States is of especial interest, because it is the only recent one of our country on which so high a degree of engraving skill has been concentrated, for the establishment of Justus Perthes in Gotha stands unsurpassed in the world for the exquisite delicacy of its work in geographic engraving.

To the editor of these sheets, Mr. Hermann Habenicht, belongs high credit for the painstaking labour he has bestowed on the compilation. There is, so far as the writer is aware, no map of the United States on which so much geographic detail is clearly shown on the small scale of 61 miles to the inch; and, so far as he can discover from a careful inspection of the sheets, there is practically nothing which has been omitted in the matter of topography and drainage The culture has also received careful attention; for the number of places with names is exceedingly great, and almost no place that has been located on any of the larger maps has been omitted from this laborious compilation. These maps, therefore, in point of completeness and accuracy of geographic detail, stand certainly unsurpassed, and probably unequalled.

To publish such a series of maps without errors of any sort would be beyond the scope of possibility; and on account of the international character of the publication, the writer has given a somewhat critical study to the errors which appear in it, believing that from them a useful lesson might be drawn as a guide to others in the compilation of similar maps, and possibly to the publishers of the sheets in question for the preparation of future editions. The errors observed are mainly in names, and are of several classes, which may in general be stated as follows:

a. Mis-spelling of names which have no obvious ordinary meaning, and which, therefore, require geographic knowledge for their detection.

Under this heading one may note at random: Sheveport for Shreveport, La.; Chipple Creek for Cripple Creek, Col.; Fernandino for Fernandina, Fla.; Tomocacori for Tumucacori, Arizona. Many such instances could be cited.

b. Mis-spelling of names which have an ordinary meaning, and in which errors could be detected by a well-educated person. Errors of this class are especially noticeable within the former limits of New Spain.

As one looks over the southwestern portion of the United States, in the territory obtained from Mexico by conquest and purchase, as well as south of the national boundary within Mexican territory, one notices many errors in spelling which would have been detected if the map had been placed under the inspection of a proofreader who knew Spanish. At random we observe in Sonora, Viñateria for Vinateria; Cineguilla for Cienaguilla. In Arizona, Navajoe for Navajo; in New Mexico, Alamagordo for Alamogordo; in California, Cayole for Coyote, and Santa Anna for Santa Ana.

c. Mis-spelling of names which in other parts of the sheet are properly spelled.

Under this head we notice Papayo and Papago, Pesqueria and Pesqueira.

d. Inconsistency in the linguistic treatment of names of geographic features, using indiscriminately German, Spanish, and English words for the same feature.

It is primarily observed that the English words *lake* and *river* have been used with great uniformity throughout the United States, but in regard to some of the other features a random use of German has crept in; for instance, in Nebraska we find Sand Hills, but in Wyoming we find *Sand Dünen.* So, also, in Southern California we find Salton *See,* and at the mouth of the Colorado River *Schlammbänke.* So, also, on the coast of the United States the

English word Bay is used almost universally; while on the coast of British America, German and English, and on the coast of Mexico Spanish and English equivalents are used in bewildering alternation.

On the west coast of Vancouver's Island we find Quatsino *Sund,* Kiyoukut *Sund,* Nootka Sound, Cloyoquot Sound, Barclay Sound. So at the mouth of the St. Lawrence River we find River St. Lawrence, Canadian Channel; St. Lawrence *Golf,* Belle Isle *Strasse.* In the interior of Canada we find Lake of the Woods, Lake Winnipeg, Lake Athabasca, and then, suddenly, *Grosser Sklaven See, Grosser Bären See,* and the names of various Indian tribes in German. So, also, we read Lake Huron, Georgian Bay, and a little farther north Hudson *Bai,* James *Bai.*

On Sheet 89 we read Baja California, and immediately beside it *Golf von Californien.* So, also, Bahia Viscaino, and immediately beside it Cristobal *Bai.*

On Sheet 85, the general map of the United States, we find Baja California changed to *Nieder Californien;* and on Sheet 82, the general map of North America, we find *Halbinsel Californien.*

As Baja California is the name of one of the organized Territories of the Mexican Republic, these variations in terminology seem wholly indefensible.

On Sheet 85 we find *Neu* Mexico, although we also find New York, New Hampshire, and New Jersey, and we are somewhat surprised to see Nova Scotia turned into *Neu Schottland* and New *Brunswick into Neu Braunschweig*. Lake Superior also stands out in contrast with Huron *See,* Michigan *See,* Erie *See,* and Ontario *See.*

On Sheet 82 we are further interested in finding Lake Superior translated into *Oberer See,* the necessity for which is not at all evident.

On Maps 82 and 85 we find St. Lawrence spelled *St. Lorenz,* although on the sheet of East Canada the English form is used.

On looking at maps of various portions of the British Empire to ascertain what rule has been followed there, we see that in the British Isles English words are used throughout. So, also, in Australia. In Hindustan and vicinity, however, both German and English terms are used.

In the Philippine Islands Spanish and German terms are employed.

On the West Indian sheet, No. 93, we see a puzzling variation in the names of waterways; while our English word "key," for a small island, has been replaced by *cay*, even in the name of our City of Key West. Republik Domingo is possibly an engraver's error for Santo Domingo.

e. Omissions, mainly in railroads and railroad stations.

The writer had with him the sheets in question during a recent trip through the southwest, and observed that a number of the newer railroads were omitted, notably the El Paso and Southwestern; in Arizona the railroad between Phœnix and Prescott, that from Williams to Grand Canyon, and some others. In this connection arose, no doubt, a question as to sources of information. The published maps, accessible to the compiler through the ordinary channels, would probably be deficient in some of the latest railroads; but if he had provided himself with some of the latest time-tables—or, better still, the commercial railway guides, which are published and revised monthly—he would have had the latest information in an intelligible form.

In ethnology some expert guidance will be necessary for future editions. The following special errors are noted:

The Apache Indians are shown on Sheet 89 as occupying most of the southern border of New Mexico and Arizona, while it is well known that since the capture of Geronimo in 1884 they have been restricted to certain reservations. Some variations are also noticed in the spelling of Indian names; for instance, Kioway, Navajoe (alluded to in class *b*).

A very remarkable bit of information comes to light in Southeastern Kansas, which is indicated as the habitat of a tribe of *New York Indians.* Just what fact was to be conveyed by this record remains to be determined.

A marked example of national expression is to be observed on the western limit of the United States where the Pacific Ocean is labelled "Grosser Ocean." While one expects linguistic variations from the time-honoured name of Pacific Ocean, to depart so materially from this earlier name of distinct priority seems to have the same degree of logic as for a German geographer to assign to the Mississippi River some such name as "Grosser Fluss." It is to be hoped that the future tendency of mapmakers will be to reduce the number of geographic synonyms.

A variation is also noted in the abbreviation for the word Mountains, which in common English usage has come to be Mts. The sheets under discussion use indiscriminately Mounts., Mts., and Ms. It would seem to the writer that one abbreviation were far better than three.

The map of Mexico gives very satisfactory expression to the topographic features of this remarkable country, and is probably the best small-scale map of Mexico in existence.

The main conclusion to be drawn from a critical inspection of these maps is that the publishers' staff is more highly trained in geographic compilation and engraving than in literary criticism. No very serious matter, perhaps, but still one worthy of consideration in the preparation of future editions.

In regard to possible improvements in compilation, the writer would suggest the revision of those parts of Sonora and Chihuahua shown on Sheet 89 of the Southwestern United States. Here, the boundary between these two important States is omitted, the drainage needs revision, and much detail might be added by referring to the best maps of Sonora—namely, that of Herbert, published in Nogales, and that of Max Bohmer, of Hermosillo, engraved by J. Köhler in Hamburg.

With all the painstaking effort in general compilation one notices a lack of quantitative expression in continental relief. For the United States the 40-mile contour map of the U. S. Geological Survey put in small scale by the experts of Justus Perthes' establishment would be a marvel of physiographic detail. In this respect the physical maps of the various continents published in Vivien de Saint Martin's General Atlas, now continued by Schrader and issued by Hachette in Paris, are worthy of attention for their exquisite detail and harmonious, distinctive, and expressive coloring.

A FIELD FOR STUDIES IN REGIONAL GEOGRAPHY.

BY

WALTER S. TOWER.

The Evolution of Geography.—Geography, in name at least, finds a place among the earliest sciences, but during its life the content of geography has undergone material changes. Until the nineteenth century geography was almost entirely descriptive, concerning itself with the study of the earth *and* its inhabitants. There was little place for explanation, and hence little correlation between the two elements. The first definite change was effected in the early part of the nineteenth century by the introduction of explanation along with description. Explanation brought out the relationships previously unemphasized, and geography came to be the study of the earth *in relation to* its inhabitants. The idea of inhabitants was still almost synonymous with man. The element of human interests, therefore, was chiefly emphasized, while the side of plant and animal responses, in general, received little consideration.

The second change, by which geography was brought down to its present status, came about in the latter part of the last century as a result of the newly-propounded theory of evolution. The dawning idea that the earth had not been adapted to the convenience of its inhabitants, but that the inhabitants had gradually adapted themselves to their environment, made it necessary to regard geography no longer as the relation of the earth and man alone, but as the relation of the earth and life. The study of the fleshy leaves of desert plants was thereby made to belong to geography as much as do the fleetness of foot and the coloration of the animals, the long abstinence from drinking on the part of the camel, or the swarthy skins and nomadic habits of desert peoples. The turned-up leaves of a morning-glory on the sand dunes of Bermuda are items of geographic interest in the same way as are the white dress and the open huts of the Filipino native, or the snow houses and the bone implements of the Esquimaux.

Divisions of Geography.—The subject of geography, therefore, arranges itself naturally under two heads: the one dealing solely with the conditions of the physical environment, the other including all the responses that life has made to its environment. The former division has long been known as physiography, and has received much attention; the latter division has practically no generally-adopted name, and has, until recently, received but relatively little attention. For this division Professor Davis has suggested the term *ontography*—analogous in form and derivation to the associated term physiography—but it is rarely seen in print. In its place, rather, are found such compromises, or partially descriptive, terms, as "political," "commercial," "economic," "historical," anthropo-, zoo-, or phyto-, geography. Many of these terms are indefinite at the best, overlapping one another to such an extent that the province of each is but poorly defined even in the minds of those by whom they are commonly used. But the terms are still apparently destined to become firmly rooted in popular usage because of the degree of suggestion of the special field with which each is supposed to deal.

Present Tendencies in Geography.—The last decade has seen a great advance in the emphasis placed on the importance of geography as a study co-ordinate with others, and also as a fundamental influence in history, economics, and kindred subjects. Perhaps the best indication of this growing interest is shown in the many books for general reading and reference, and for use as texts, dealing with different phases of geography from a great variety of standpoints. Whole series of books of travel and exploration have been published, others are in the process of completion, under the name of geography, to catch the fancy of the many to whom geography is a new and, perhaps, passing interest. Many of these volumes contain much of value and interest to the trained geographer, and as a source of collateral reference they serve a useful purpose. But the general method of presentation is too often popular and at random, rather than that of intelligent, correlated interpretation. It is more of a reversion to simple description after the idea of a century ago than it is an advance according to the present understanding of the word "geography." The element of relationship between environment and life, instead of being vivified and dressed attractively, must too often be worked out by the reader or else lost entirely. These books, as a rule, deal with but a small chapter of geography, with a single country, as India, Arabia, or Japan; or with a single series of explorations, as along the Nile or the St. Lawrence valleys. In their generally readable form, however, they are valuable toward creating an ever greater interest in geographical knowledge; and in the character of the subject presented they may be regarded as forerunners of a general tendency in geographical studies.

The other great class of publications, the field of text and of special reference books, has been equally important, though perhaps less prolific. These books include texts of physiography; elementary and advanced geographies; texts of commercial and economic geography; and of historical geography, written according to all varieties of scope and methods of treatment. Among them also are found the exponents of the so-called "new" geography, who imply that the responses of life to its environment have recently undergone radical changes. So numerous are the different texts that in many ways there seems to be little need for additional attempts at mere re-statement. This is especially true with reference to physiography, while on the ontographic side it is, perhaps unfortunately, not so true. In the texts, aside from physiography pure and simple, the criticism can be applied almost without qualification, that they are throughout too historical, commercial, or economic, and not enough geographic. The commercial or historical aspects are set forth clearly enough, exact and in sufficient detail, but the setting made by the physical environment is lacking: the element of relationship in the commercial or historical response to the environment is not always plainly or sufficiently brought out.

The realm of the fundamental principles in geography has been thoroughly covered in the many volumes which deal with different phases of the subject. Many of the elementary texts can necessarily deal only with the simplest and most important underlying facts, and therefore make man the most conspicuous consideration on the side of life. More complete texts include greater amounts of detail, but still are confined by space to matters of general, rather than of individual or of local importance. Before geography can be regarded as complete, however, these lesser details of local importance must be studied and grouped appropriately along with the large items.

Regional Geography—an Advance.—Herein, it seems, lies the direction for future advance in geography. The utilization of the general principles, applied to restricted areas rather than to world-wide forms and responses, will make possible greater attention to the local items, and will enable the working geographer to describe and explain every part of the area which he observes. Just as in the general studies only the more important land-forms can be described, usually by a type example, so only the larger responses, usually of man, can be explained. But when the area is limited, the number of forms is less and the smaller items with their responses find their appropriate places. Such studies in regional geography seem to offer the most profitable field at present for the active geographer.

The first step along the new way is apparently indicated by the great number of recent books, already referred to as semi-descriptive, semi-geographic in nature, dealing with different countries and regions of the world. Such books may well be regarded as forerunners of thorough, systematic regional studies, in much the same way that the descriptive attitude of a century ago was the forerunner of the present-day geography. In some of our own States there have already been thorough studies of the physical features; Maryland, New Jersey, and New York have furnished material for accurate studies in regional physiography. Only the relationship of life needs to be added to make complete correlated regional geographies.

Relation of Regional and Systematic Geography.—A regional geography, however, should be more than correlated, more than descriptive or complete in explanation. It must be systematic.

That general geography must be systematic is usually accepted by most teachers and students at the present time, though there is still an unfortunate diversity of opinion concerning the bases, and the order, of classification. Only by following some sort of system, however, can regional studies have any value with reference to the general study, or in comparisons with similar studies in other regions. If in every area each item is described as an unclassified special item, the most valuable part of the study, the element of relationship, the similarities and differences in a class of forms and responses, is lost. Therefore, to adopt some logical systematic scheme of classification which the regional study is to follow, becomes the duty of the geographer at the very outset. Such a classification is preferably drawn from general systematic geography, using every head and sub-head which has an example in the given region. This procedure not only simplifies the geographer's task, but also makes more apparent the actual contribution to the advancement of geographical knowledge.

A Logical Classification.—The most acceptable classification must be the one which is based on the simplest, yet most universal and fundamental characters: a classification at once broad enough to include every world-wide item which may be found, and yet capable of being applied to any region, however restricted in extent or variety of conditions. Systematic classifications are usually based solely on the characters of land-forms; while the responses of life, when classified at all, are grouped under the heads of the forms to which they are most closely related. As meeting the desired requirements, it has been suggested that:*

> Land forms are classed first as to kind, according to their rocky structure; thus one area may be of horizontal structure; a second may consist of broken and tilted blocks; a third may have a domed structure; a fourth may be folded; a fifth may be of volcanic origin, and so on.
>
> Each kind of land form is then to be classified according to its stage in the cycle of erosion, to which it is introduced by initial processes of deformation and (relative) upheaval, and through which it progresses by the action of weathering and washing, toward an ultimate goal of obliteration in a featureless plain close to sea-level, or in a smooth platform at an undetermined depth beneath sea-level. There is to-day abundant warrant for asserting that the sequence of developmental stages through this destructive cycle of erosion is remarkably systematic, and that very effective description of land forms may be given by characterizing them simply as young, mature or old.

Advantages of Classification.—Such a classification, framed for the whole realm of geography, so as to include the broadest conditions of world-wide importance, is no less readily adapted to smaller areas in regional studies. Two illustrations may be drawn from a study of Pennsylvania, where the same series of strata appear in the anthracite and in the bituminous coal fields. The first may be classified under the fourth head suggested above, as closely-folded mountains; the second area may be classified under the first head, as a plateau of nearly horizontal strata; while to both may be added the description, on the basis of stage of erosion, "once base-levelled and again elevated and maturely dissected." This designation should immediately prepare the student for certain general conditions to be met—notably, accordance of upland levels, more or less rugged relief, habitations and lines of travel largely confined to the valleys, and so on. It therefore no longer becomes the geographer's task to recount the general features of all folded mountains or of all plateaux. He is free to devote every attention to the features peculiar to the individual region under discussion. By building from the general knowledge already possessed by the reader, the study can be carried to greater detail of description and more complete explanation of complexity, both in the environment and in the responses of life.

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* Davis, W. M.—"Systematic Geography." Proc. Amer. Phil. Soc. Vol. XLI. No. 170. 1902. p. 243.

More Detailed Classification Necessary.—But in order that there shall be places in the scheme to receive those items necessarily excluded from the general treatise, there must be added elements brought forward to serve as bases of classification. There must be smaller sub-heads than can be made on the basis of rock structure and the amount of erosion on that structure. The effects of erosion on any given structure will be manifestly different when the strata are homogeneous, and when they are of varying texture. The texture of the rocks, therefore, becomes a natural and logical basis for further subdivision necessary for regional studies. If the folded mountain region of Pennsylvania is described as above as a folded mountain region, etc., certain general features are suggested; if described as a closely-folded mountain region, with alternating hard and soft strata, etc., the anticipated features at once become more specific. The alternation of even-crested ridges and narrow linear valleys is expected, as a result of differential rates of erosion, and many conditions of life may be predicted, as forested, untilled ridges, fertile populous valleys, and so on. Or, again, to say "a maturely-dissected plateau of nearly horizontal strata" means one thing, while to add "of varying texture" means much more of detail. In the general study there is not space for the details of lesser characters. The regional study, however, meets the need for their explanation; it is their proper place, and there they must be included.

Other factors besides rock texture must often be used as minor bases of classification. Humid and arid climates, and glaciation, for example, all mean different physical forms produced and preserved, and hence different influences on life. A maturely-dissected plateau in the moist climate of Pennsylvania will not exhibit the same sort of sculpture by erosion and the same controls of life as will a maturely-dissected plateau in the arid West. An unglaciated portion of the plateau in Southern Pennsylvania does not present the same conditions as do the glaciated portions along the New York State line. A volcano in Ecuador may be identical in size and form with a volcano in Alaska, but the responses of life will be widely different in the two cases.

Terminology.—Physiography makes use of the terms young, mature, and old in describing well-known features characteristic of certain degrees or stages in the cycle of denudation, entirely apart from any idea of organic response. As pointed out in a recent article:*

> Confusion might easily arise if we try to classify a *region*, characterized by diverse features, as young, mature, or old.

But the difficulty is not with the terms or with the system in which they are employed. The difficulty is in applying them to a *region*, whereas they were intended as terms descriptive of *features* in a region. It is the province of general geography to describe and explain the conditions characteristic of land-forms, plains, plateaux, mountains, and rivers, in youth, maturity, and old age. Drawing illustrations is necessary, as in using western Pennsylvania and West Virginia as an example of a mature plateau, but not necessarily a region which is mature in every element of the topography. The student of a region must, therefore, constantly guard against the application of his special terms to the area as a whole. To give the appropriate conditions for every topographic feature, in whatever stage of development it may be, is one of the chief aims and purposes of the regional study, for only by that means can the complexity of conditions find an adequate explanation.

The Logical Successor of General Geography.—The nature of the regional study, therefore, makes it the logical successor of the general study. Without the preliminary training of the general systematic geography, the principles of which are to be applied to a given region, the study of the region can be of little more value in geography than would be regional studies in botany or zoology without a knowledge of the principles of plant or animal classification. Hence the regional study becomes valuable not only to the young student in geography, as furnishing a source of detailed information, but it is valuable also to the advanced student and to the working geographer as offering a field in which he may build from the foundation already possessed, test the practical value of his scheme of classification, and in an intelligent interpretation of a region give an actual contribution to geographical knowledge.

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* Johnson, D. W.—"Youth, Maturity, and Old Age in Physiographic Forms." Bull. Amer. Geog. Soc. Vol. XXXVII. No. 11. Nov. 1905. pp. 649-650.

Difficulty in a Broad Field.—A regional study—as of a State, for example—in order to be complete, must include a thorough description of all the physical features, properly classified and referred to their places with respect to the whole group of land-forms. Along with this description must be included the explanation of every condition of life in so far as it has been determined or modified by the physical environment. It must give the responses of man in his activities, social, political, historical, and economic; of plants and of animals, in their distribution, selection, and adaptation. Each must receive its proper weight and bear its relationship to the class in which it belongs.

It may be argued that, to be entirely logical in the systematic presentation, every influence on life should be grouped along with the appropriate land-form from which it is a response. But in any extensive study, as even of a single State like Pennsylvania, the diverse physical conditions entail many complex organic responses, and may make it advisable to divide the discussion sharply under two heads: under the one, physiography alone; under the other, all responses of life. Such a division not only favours clearness of presentation in a complex subject, but also gives more readily-contrasted conditions in the different areas, with a minimum degree of repetition.

Usefulness.—For a series of such regional studies as here outlined, there is an actual urgent need at the present time. Geography has an important place in the schools of all grades throughout the country. General text-books are available, with texts written according to schemes varied enough to meet the demands of every teacher and every class of pupils. The general importance of environment to human activities, in their broader aspects, is set forth in part in the texts of the commercial and the economic geography type. The increasing need now is for thorough studies of separate regions, by which the broader training may be supplemented. It is more often the local conditions which most closely affect the individual, and which make the subject most alive, especially to the student of one or two years' standing. And it is the local conditions which hold the most important place in regional studies.

Excellent histories of many of the States in the Union have met the demand for regional studies in history. But almost nowhere has there been an attempt at similarly complete accounts either of the physical conditions which the pioneer met, or of the influences which these conditions have exerted over the subsequent development of the regions. To have such a series of regional geographies for each State or group of States in the country would mean a great stride toward a better and a more general understanding not only of the economic and the social development, but also of history and political conditions as well. Such studies should be of value, not alone to the student of geography, but also to the historian and the economist. They should be of value, not merely to the people of the State or region, but to every one who would gain an idea of the different elements on which the units of the nation have been built.

University of Pennsylvania.

AN AMERICAN PANAMA.

Some Personal Notes on Tropical Colonization as affected by Geographic and Political Conditions.

BY

POULTNEY BIGELOW, M.A.,

Life Member of the American Geographical Society; Fellow of the Royal Geographical Society, London.

Three points of view are at present important in the discussion of our new acquisition, Panama:

First, the engineering problem;

Secondly, the conditions of life as affected by climate or geographical conditions;

Thirdly, the colonial aspect, or the relations of the future colony to the government responsible for its development.

As to the engineering point of view, I can say nothing at first hand; but, in view of the political acrimony just now creating a cloud of doubt about this great enterprise, I venture to affirm that, at least in the opinion of several of the most eminent engineers of this country, if not of the world, the task of digging a canal from Colon to Panama offers no physical difficulty which would for a moment discourage men familiar with great engineering tasks of recent years in this country, such, for instance, as the New York Subway.

Notable it is, to be sure, that our great engineers are not crowding forward to offer themselves as servants of our Government in this crisis. On the contrary, they not only decline service, but they hesitate to express opinions in public, for fear of inviting the ill-will of politicians, who resent criticism.

Secondly, our discussion touches upon the condition of life in the tropics generally and Panama in particular, and here we must carefully sift evidence, because so many men who visit a tropical country for the first time are apt to measure things there exclusively by the standards to which they are accustomed in a northern climate.

For my part, I may be permitted to interject here that Panama is not the first tropical country that I have visited—that, indeed, I have made a study of nearly every tropical colony in the world, including the German islands of New Guinea, where I cruised alone in my canoe to places which the German Governor assured me no white man could approach without risk of being eaten up by cannibals.

This was my fourth visit to the Caribbean, and before these visits I had studied the negro as a labourer in every colony of South Africa, including the Portuguese Mozambique.

I had sailed my canoe around both Antigua and St. Thomas in the West Indies, in order to study the negro at closer range than is usually possible to the tourist, and had, besides, had opportunity of studying him in each of our own Gulf States at different times.

The labour problem is the great, if not the only, problem demanding serious and immediate attention at Panama, and it is one so intimately bound up with the future of Panama as a colony that it deserves scientific treatment, wholly divorced from the momentary needs of party politics.

To-day we have at the Isthmus a white population numbering only a few hundred, who are mainly from the Northern States of our Union, and who are engaged as inspectors and in clerical work generally. They live in the least unhealthy portions of the Zone, are paid in gold, while the negroes are paid in silver, and altogether represent the momentary aristocracy of our colony.

Then, we have the body of labourers or colonists who are almost wholly alien negroes from British islands—who speak only English, and who have been reared under a colonial system where the respect for law is universal, where judges are appointed for life, and where political influence has never been suspected amongst those seated on the bench.

Note, then, that Panama so far has drawn no negroes from our own Southern States, but only negroes who have no votes on our territory, and, consequently, represent no political force.

Experience with negroes teaches that the success of planters depends largely upon the relative capacity of masters to make their workmen happy in their work. I have visited plantations practically equal in soil, climate, and number of hands, and yet while one landlord will praise his men and close his year's balance with a smile, the other will curse the negro as a stupid brute and find fault with everything—save himself.

This is almost universally seen in every country where the negro is the main labourer. I have noted it in tropical Africa no less than in different parts of the West Indies, and I am sure that hundreds of our Southern planters will confirm it within their own experience.

My stay on the Isthmus lasted two days—ten hours of one day and ten hours of the second day, with eight hours for sleep.

One day was a holiday, the next was a working day; so I saw my people at work and at play.

Of those two days I spent the major part in the swamp called Colon—a pest-breeding wallow nearly a mile long, immediately back of the show street which fronts the waters of the Caribbean Sea.

In this swamp I was accompanied by Mr. Tracy Robinson, who is one of the oldest residents on the Isthmus and also one of the most respected. He has published a volume of poems, and has been repeatedly invited to deliver the oration on national holidays by his American fellow-citizens.

My other companion into the swamp of Colon was Mr. Sands, our Secretary of Legation at Panama, a worthy representative of our country. With these two gentlemen I made many photographs showing the state in which several thousand negroes are living under conditions disgraceful to us as a Christian and progressive nation. The people in this swamp have come to the Isthmus at our invitation and have a right to expect the common decencies of life, such as water to drink, streets that can be used, and places where they may throw their sewage and excrement without leaving it to pile up at their very doors.

The climate is by many looked upon as the cause of the fevers at Panama, but this I venture to doubt. There are many analogies to Panama and Colon throughout the colonial world, and these analogies, when studied historically, lead to the conclusion which harmonizes with experience, that tropical climate may be much modified by human foresight and energy.

For instance, Durban in Natal, which I visited in 1896, was already then a favorite seaside resort for the Boers of the Transvaal; and yet within the memory of men then living it had been a place notorious as a hotbed of fever.

To the late Sir Harry Escombe is mainly due the credit of having brought about the public sentiment which raised the necessary taxes to drain the swamps and thus abolish mosquitoes and fever at the same time.

We have but to drain the Colon swamp, and fevers will disappear, as they have from many other places situated in similar geographical positions.

To-day the Portuguese port of Delagoa Bay is suggestive of Colon in the filthy neglect of sanitary measures—yet Delagoa Bay is practically close neighbor to Durban. All she needs is a little British enterprise and honesty, and she, too, will become another health resort.

Demarara, at the mouth of the Essequibo, would be another Colon but for the far-sightedness of the original Dutch colonists in treating their swamps according to the example of the mother country; and the British, who now rule that rich dependency, have continued to keep it well drained, and, therefore, healthy. You do not hear any complaints about mosquitoes and malaria in Demarara.

The moral of all this is, that we might do well to send to some tropical colonies, where conditions are analogous, and borrow for our own use some administrators familiar with the problems confronting us here. Or, if that runs counter to our national pride, then let us do the next best thing and select for our managers, inspectors and bosses generally, not men from Ohio or Michigan, but rather draw our canalization forces from the Gulf States of the Union. Let us choose young men who have a good record as managers of plantations, who stand well with negroes, who know their habits and humours, who are honest and good-tempered, yet firm.

The negro is an easy man to work with if you understand him, and it is of the highest importance that we select for canal jobs white men who do know the negro; but, unfortunately for us, most of our white men who do know the negro have probably voted the Democratic ticket!

The geography of Panama as a colony is most encouraging—a diversified landscape, abundantly watered and capable of growing almost everything demanded by reasonable colonists.

To-day we have not yet any laws under which a settler can acquire land or even a leasehold. Consequently, there is not yet a beginning of farming, and until this arrives we must expect high prices for provisions and consequent dissatisfaction amongst those who do not enjoy canned food in the tropics.

Under an honest and efficient colonial rule we may look forward to the building of roads throughout our new possession, the draining of all swamps, and the accurate surveying of the land, in order to encourage settlers who come for the purpose of providing fresh vegetables and dairy produce to the thousands already there and to the hundreds of thousands whom we may anticipate as the result of good administration.

It is easy now to look ahead and protect the people against the evils incident to land speculation. The Government should retain all rights as a paramount landlord, and permit people to purchase only on condition that in case they resell, then the Government shall be entitled to buy back the land at a just valuation, and not at the fancy price which tempts the land speculator.

Germany has wisely introduced this principle of land tenure in Kiao Chau, and, from what I am able to gather, it works admirably.

Then, too, tropical climates demand that white men who go there as colonists keep their bodies well toned up physically—for physical depression may soon be followed by mental depression, and then follows disease, and then, off for home, with a tale of the "horrible climate!"

Tropical colonies teach the lesson that the successful administrators are those who themselves take plenty of outdoor exercise each day and who insist upon corresponding exercise in their subordinates.

The Germans fail to get the best out of their colonies for the reason that their administrators are, as a rule, men with no interest in healthy sports, but inclined to spent their evenings round a beer table rather than on the polo field or in kicking a football.

On the canal Zone, although I went the whole length of the canal strip and back and talked with many employees there, I could find scant trace of any interest in out-door sports, so far as the Government administration is concerned.

Before the canal can be built the matter of making people contented on the Zone must be studied by those who have had previous experience with the elements of this problem.

The negroes who come to us must have their families, if they are to remain more than a few months.

Before we can make progress in this great work, we must face the truth and lay broad foundations. This is impossible if we continue to permit this work to be the sport of politicians and the jobbery which inevitably springs from an enterprise where there are half a dozen commanding generals, immense opportunities for mistakes, miles of red tape, and many millions of dollars yet to spend.

GEOGRAPHICAL RECORD.

AFRICA.

TWO ARTICLES ON THE MAHARI (dromedary or African camel)—one by Capt. Mathieu and the other by E. Michal, interpreter, etc.—deserve notice, the former for its information on reproduction and raising of the dromedary, the other for a detailed account of the diseases and accidents to which the animal is exposed. Not less than twenty-six infirmities or lesions are enumerated, and—what is more valuable still—the methods for relief used by the Arabs are circumstantially given. For zoological gardens or wherever attempts are made to introduce the camel away from its home, the article of Mr. Michal is of importance.—(*Bulletin* of the *Société de Géographie d'Alger et de l'Afrique du Nord, &c.*, 1905, third quarter.)

ACROSS MADAGASCAR.—An entertaining and matter-of-fact description of a journey from Tamatave to Maintirano in 1902, by E. F. Aside from pleasing descriptions, it contains some not indifferent data concerning the early history of the Hovas, the information (not new) that these did not by any means control the whole island, and considerable ethnologic information of a cursory kind. The opinion as to the value of Madagascar for France is certainly not exaggerated.—(*Bulletin, Société de Géographie d'Alger.*)

THE BERBER WOMAN IN ETHNOLOGY AND ALGERIAN HISTORY.—This posthumous paper of Lieut.-Col. Rinn deals with the position of woman among the Berbers, but begins with a defense of Mahommedanism in its relations to the female, asserting that "the supremacy of Islam in Berber society has frequently maintained and legitimized the part played by woman, in the ethnology and history of northern Africa." The interesting fact is established that the Berbers, in times long past, had matriarchy, the names of many of their subdivisions as well as tradition indicating descent in the female line. Follows a long list of women celebrated among the Berbers for remarkable actions, all given in support of the claim that Mohammedanism concedes to woman a much higher place than generally supposed. Since the author of this rather imperfect essay is no longer among the living: *De mortuis nihil nisi bene.*—(*Bulletin, Soc. de Géog. d'Alger.*)

A LIVING OKAPI SEEN.—Captain Boyd Alexander of the Alexander-Gosling Expedition, which arrived early in March at Bima in the Congo Free State, has written to England that the expedition has secured a specimen of the okapi and that he has seen the animal alive. A letter from Captain Gosling, under date of February 26, says that Captain Alexander is sending a description of the specimen secured. The interest in this curious ruminant, which is related to the giraffe but simulates the zebra in its markings, is due to the fact that it was discovered by Johnston only a few years ago and is confined to a narrow habitat in the northeast part of the Congo Free State, though in past geological ages it appears to have been distributed much more widely, and even to have inhabited the south of Europe. At least it is asserted that it is practically an okapi which Professor Gaudry found in a fossil state in the pikermi beds, Peloponnesus, and which was named the *Helladotherium*. Captain Gosling sends some notes on the okapi as it exists in the forests of the Welle, Libuati, and Rubi Rivers, which will be read with interest:

> The okapi here is generally found singly or in pairs, but Mobatti hunters say that sometimes three are found together. An essential to its life is a small stream with some swampy and muddy ground on either side. In this grows a large leaf that on its single stock attains a height of ten feet. The young leaf of this plant is the favorite food of the okapi; and I venture to say that where the plant is not found the animal will not exist. During the night he will wander along in the mud and water in search of it. Here he may be found feeding as late as 8 A.M., after which he retires to the seclusion of the forest, where he remains till nearly dusk. On the three occasions that I was at close quarters with the beast he was perfectly concealed in this water leaf. Near the river Welle I found his spoor on ground frequented by buffalo and water buck; but this is unusual, and his companions in the forest are the elephant, the greater bush buck, and the yellow-backed and small red duikers. The okapi is very quick of hearing. He is killed occasionally by the natives, being speared, shot, or trapped by the common African methods. , At the first village I visited three had been speared at various times.

AMERICA.

THE CALIFORNIA EARTHQUAKE.—On the 21st of April the Governor of California issued the following letter:

> TO WHOM IT MAY CONCERN:
>
> The bearer, Professor A. C. Lawson, of the State University, together with Professor G. K. Gilbert of the United States Geological Survey, Professor Fielding Reid of Johns Hopkins University, Professor J. C. Branner of Stanford University, Professor A. O. Leuschner of the State University, Professor George Davidson of the State University, Professor Charles Burkhalter of the Chabot Observatory, and Professor William Wallace Campbell, Director of the Lick Observatory, are hereby constituted a Committee of Inquiry into the earthquake phenomena in all parts of the State of California, and the citizens of the State are hereby requested to co-operate with this committee in all possible ways, affording them all necessary information and access to the results of the earthquake disturbances.
>
> GEO. C. PARDEE,
> Governor of California.
>
> Dated Oakland, Cal., April 21, 1906.

The Commission met for purposes of organization on April 24, at 12 o'clock noon, in the University of California. Professor Andrew C. Lawson was elected Chairman, and Professor A. O. Leuschner Secretary. For purposes of correspondence it was decided that the Commission should be known as the "State Earthquake Investigation Commission." It was determined that the scope of the work of the Commission in its preliminary stages should embrace the questions as to the origin, the position, and the character of the disturbance in the earth's crust which gave rise to the earthquake, these questions to be investigated by:

1. The location of fault scarps and other deformations of the surface of the ground or sea-bottom in the region affected;
2. The collection of intensity records leading to the construction of coseismal curves;
3. The collection of intensity records and their classification in a graded scale leading to the construction of isoseismal curves.

The Preliminary Report of the Commission, submitted May 31, is as follows:

One of the remarkable features of the Coast Ranges of California is a line of peculiar geomorphic expression which extends obliquely across the entire width of the mountainous belt from Mendocino County to Riverside County. The peculiarity of the surface features along this line lies in the fact that they are not due, as nearly all other features of the mountains are, to atmospheric and stream erosion of the uplifted mass which constitutes the mountains, but have been formed by a dislocation of the earth's crust, or rather a series of such dislocations, in time past, with a differential movement of the parts on either side of the plane of rupture. In general this line follows a system of long narrow valleys, or where it passes through wide valleys it lies close to the base of the confining hills, and these have a very straight trend; in some places, however, it passes over mountain ridges, usually, at the divide separating the ends of the two valleys; it even in some cases goes over a spur or shoulder of a mountain. Along this line are very commonly found abrupt changes in the normal slope of the valley sides, giving rise to what are technically known as scarps. These scarps have the appearance of low precipitous walls which have been usually softened and rounded somewhat by the action of the weather. Small basins or ponds, many having no outlet, and some containing saline water, are of fairly frequent occurrence, and they usually lie at the base of the small scarps. Trough-like depressions also occur bounded on both sides by scarps. These troughs and basins can only be explained as due to an actual subsidence of the ground, or to an uplift of the ground on one side or the other, or on both sides. The scarps similarly can only be ascribed to a rupture of the earth with a relative vertical displacement along the rupture plane. Frequently small knolls or sharp little ridges are found to characterize this line, and these are bounded on one side by a softened scarp, and separated from the normal slope of the valley side by a line of depression. In many cases these features have been so modified and toned down by atmospheric attack that only the expert eye can recognize their abnormal character; but where their line traverses the more desert parts of the Coast Range, as for example in the Carissa Plains, they are well known to the people of the country, and the aggregate of the features is commonly referred to as the "earthquake crack."

This line begins on the north at the mouth of Alder Creek near Point Arena and extends southeasterly nearly parallel with the coast line to a point about two miles below Fort Ross, a distance of forty-three miles. Here it passes outside of the shore line and is again met with at the point where Bodega Head joins the mainland. Thence it appears to continue southward through Tomales Bay and Bolinas Lagoon. Beyond Bolinas Lagoon it passes outside of the Golden Gate and enters the shore again at Mussel Rock, eight miles south of the Cliff House. From this point it is traceable continuously along the valley line occupied by San Andreas and Crystal Springs Lakes, past Woodside and Portola, over a saddle back of Black Mountain, thence along Stevens Creek Cañon, passing to the southwest of Table Mountain and Congress Springs to the vicinity of Wrights, on the narrow-gauge railway between San José and Santa Cruz. From Wrights it continues on in the same course through the Santa Cruz Mountains to the point where the Southern Pacific Railway crosses the Pajaro River near Chittenden. From the crossing of the Pajaro the line extends up the valley of the San Benito River, across the eastern portion of Monterey County, and thence follows the northeastern side of the valley of the San Juan River and the Carissa Plains to the vicinity of Mount Pinos, in Ventura County. The line thus traced from Point Arena to Mount Pinos has a length of 375 miles, is remarkably straight, and cuts obliquely across the entire breadth of the Coast Ranges. To the south of Mount Pinos the line either bends to the eastward following the general curvature of the ranges or is paralleled by a similar line offset from it *en echelon;* for similar features are reported at the Tejon Pass and traceable thence though less continuously across the Mojave Desert to Cajon Pass and beyond this to San Jacinto and the southeast border of the Colorado Desert. The probability is that there are two such lines, and that the main line traced from Point Arena to Mount Pinos is continued with the same general straight trend past San Fernando and along the base of the remarkably even fault scarp at the foot of which lies Lake Elsinore. But, leaving the southern extension of the line out of consideration as somewhat debatable, we have a very remarkable physiographic line extending from Point Arena to Mount Pinos which affords every evidence of having been in past time a rift, or line of dislocation, of the earth's crust and of recurrent differential movement along the plane of rupture. The movements which have taken place along this line extend far back into the Quaternary period, as indicated by the major, well-degraded fault scarps and their associated valleys ; but they have also occurred in quite recent times, as is indicated by the minor and still undegraded scarps. Probably every movement on this line produced an earthquake, the severity of which was proportionate to the amount of movement.

The cause of these movements in general terms is that stresses are generated in the earth's crust which accumulate till they exceed the strength of the rocks composing the crust and they find a relief in a sudden rupture. This establishes the plane of dislocation in the first instance, and in future movements the stresses have only to accumulate to the point of overcoming the friction on that plane and any cementation that may have been effected in the intervals between movements.

The earthquake of the 18th of April, 1906, was due to one of these movements. The extent of the rift upon which the movement of that date took place is at the time of writing not fully known. It is, however, known from direct field observations that it extends certainly from the mouth of Alder Creek near Point Arena to the vicinity of San Juan in San Benito County, a distance of about 185 miles. The destruction of Petrolia and Ferndale in Humboldt County indicates that the movement on the rift extended at least as far as Cape Mendocino, though whether the line of rift lies inland or off shore in that region is still a matter of inquiry. Adding the inferred extension of the movement to its observed extent gives us a total length of about three hundred miles. The general trend of this line is about N. 35° W., but in Sonoma and Mendocino counties it appears to have a slight concavity to the northeast, and if this curvature be maintained in its path beneath the waters of the Pacific it would pass very close to and possibly inside of Capes Gordo and Mendocino. Along the 185 miles of this rift where movement has actually been observed the displacement has been chiefly horizontal on a nearly vertical plane, and the country to the southwest of the rift has moved northwesterly relatively to the country on the northeast of the rift. By this it is not intended to imply that the northeast side was passive and the southwest side active in the movement. Most probably the two sides moved in opposite directions. The evidence of the rupture and of the differential movement along the line of rift is very clear and unequivocal. The surface soil presents a continuous furrow, generally several feet wide, with transverse cracks, which show very plainly the effort of torsion within the zone of the movement. All fences, roads, stream courses, pipe lines, dams, conduits, and property lines which cross the rift are dislocated. The amount of dislocation varies. In several instances observed it does not exceed six feet. A more common measurement is eight to ten feet. In some cases as much as fifteen or sixteen feet of horizontal displacement has been observed, while in one case a roadway was found to have been differentially moved twenty feet. Probably the mean value for the amount of horizontal displacement along the rift line is about ten feet, and the variations from this are due to local causes, such as drag of the mantle of soil upon the rocks or the excessive movement of soft, incoherent deposits. Besides this general horizontal displacement of about ten feet there is observable in Sonoma and Mendocino counties a differential vertical movement not exceeding four feet, so far as at present known, whereby the southwest side of the rift was raised relatively to the northeast side, so as to present a low scarp facing the northeast. This vertical movement diminishes to the southeast along the rift line, and in San Mateo County is scarcely if at all observable. Still farther south there are suggestions that this movement may have been in the reverse direction ; but this needs further field study.

As a consequence of the movement it is probable that the latitudes and longitudes of all points in the Coast Ranges have been permanently changed a few feet, and that the stations occupied by the Coast and Geodetic Survey in their triangulation work have been changed in position. It is hoped that a reoccupation of some of the stations by the Coast and Geodetic Survey may contribute data to the final estimate of the amount of movement.

The great length of the rift upon which movement has occurred makes this earthquake unique. Such length implies great depth of rupture, and the study of the question of depth will, it is believed, contribute much to current geophysical conceptions.

The time of the beginning of the earthquake as recorded in the Observatory at Berkeley was $5^{\text{h.}}\ 12^{\text{m.}}\ 6^{\text{s.}}$ A. M., Pacific Standard time. The end of the shock was $5^{\text{h.}}\ 13^{\text{m.}}\ 11^{\text{s.}}$ A. M., the duration being $1^{\text{m.}}\ 5^{\text{s.}}$ Within an hour of the main shock twelve minor shocks were observed by Mr. S. Albrecht of the Observatory and their time accurately noted. Before $6^{\text{h.}}\ 52^{\text{m.}}$ P. M. of the same day thirty-one shocks were noted in addition to the main disturbance. These minor shocks continued for many days after April 18, and in this respect the earthquake accords in behavior with other notable earthquakes in the past. The minor shocks which succeed the main one are interpreted generally as due to subordinate adjustments of the earth's crust in the tendency to reach equilibrium after the chief movement.

The collection of time records necessarily proceeds slowly. The purpose of the coseismal curves based upon these records is in general two-fold. In ordinary earthquakes it is one of the means of locating the seat of the disturbance when there is no surface manifestation of the rupture in the earth's crust. In the present instance, however, the rupture has declared itself in an unmistakable rift observable at the surface, and coseismals are therefore unnecessary for the determination of this important factor in the general problem, so far at least as regards the main disturbance. It is probable, however, that so radical a change in the equilibrium of the stresses of the earth's crust would induce secondary ruptures and consequently secondary earthquakes closely associated with the chief shock. The careful plotting of the time records may, therefore, be useful in revealing the location of these secondary disturbances, such, for example, as the one which affected Southern California on the afternoon of the 18th of April. The second purpose of securing time records is the determination of the velocity of propagation of the earth wave ; and the data for this which are likely to be most serviceable are the records obtained at various quite distant seismographic stations.

The destructive effects of the earthquake are in the main distributed with reference to the line of rift. The exact limits of the area of destruction have not yet been mapped, but it is known to extend out about twenty-five or possibly thirty miles on either side of the rift. On the southwest side the greater part of this area to the north of the Golden Gate lies in the Pacific. This area extends from Eureka in Humboldt County to the southern extremity of Fresno County, a distance of about four hundred miles.

Beyond this area of destructive shock the earthquake was felt in its milder manifestations over a wide territory. Our reports to date show that it was felt in Oregon as far north as Coos Bay and on the south as far as Los Angeles. To the east it was felt over the greater part of middle California and eastern Nevada, particularly along the eastern flank of the Sierra Nevada. It was felt at Lovelocks, and we have unconfirmed reports of its having been felt at Winnemucca. Far beyond the region within which it was apparent to the senses, however, the earth wave was propagated both through the earth and around its periphery; and some of the most valuable and most accurate records of the disturbance which we have are those which were registered at such distant seismographic stations as Washington, D. C.; Sitka, Alaska; Potsdam, Germany; and Tokyo, Japan.

Within the area of destructive effects approximately 400 by 50 miles in extent the intensity varied greatly. There was a maximum immediately on the rift line. Water pipes, conduits, and bridges crossing this line were rent asunder. Trees were uprooted and thrown to the ground in large numbers. Some trees were snapped off, leaving their stumps standing, and others were split from the roots up. Buildings and other structures were in general violently thrown and otherwise wrecked, though some escaped with but slight damage. Fissures opened in the earth and closed again, and in one case reported a cow was engulfed. A second line of maximum destruction lies along the floor of the valley system of which the Bay of San Francisco is the most notable feature, and particularly in the Santa Rosa and Santa Clara valleys. Santa Rosa, situated twenty miles from the rift, was the most severely shaken town in the State, and suffered the greatest disaster relatively to its population and extent. Healdsburg suffered to a nearly similar degree. San José, situated thirteen miles, and Agnews, about twelve miles from the rift, are next in the order of severity. Stanford University, seven miles from the rift, is probably to be placed in the same category. All of these places are situated on the valley floor and are underlain to a considerable depth by loose or but slightly coherent geological formations, and their position strongly suggests that the earth waves as propagated by such formations are much more destructive than the waves which are propagated by the firmer and highly elastic rocks of the adjoining hill lands. This suggestion is supported by a consideration of the destructive effects exhibited by towns and single buildings along the same valley line which are situated wholly or partly on rock. Petaluma and San Rafael, though nearer the rift than Santa Rosa, suffered notably less, and they are for the most part on, or close to, the rocky surface. The portions of Berkeley and Oakland which are situated on the alluvial slope suffered more than the foothills, where the buildings are founded on rock. The same suggestion is further supported from a consideration of the zone of maximum destructive effect on the southwest side of the rift. This zone lies in the Salinas Valley. The intensity of destructive action at Salinas was about the same as at San José, and the town is situated on the flood-plain deposits of the Salinas River. Along the banks of the Salinas River and extending from Salinas to the vicinity of Gonzales, so far as our reports at present show, the bottom lands were more severely ruptured, fissured, and otherwise deformed than in any other portion of the State. The Spreckels Sugar Mill, situated on the banks of the river, suffered more severely probably than any other steel structure in the State. Santa Cruz, on the other hand, which is on the same side of the rift and at the same distance from it, but which is built on rock for the most part, suffered much less damage. In the northern counties along the coast the most severe effects were felt at Ferndale, on the south margin of the flood plain of the Eel River, and at Petrolia, on the bottom land of the Mattole. Fort Bragg was severely shaken with very destructive effects, but our reports do not yet indicate the character of the ground upon which it is situated.

In the facts which have been cited we seem to have warrant for a generalization as to the excessively destructive effect of the earth wave as transmitted by the little coherent formations of the valley bottoms. But it must be borne in mind that by far the greater number of structures subject to destructive shock are situated in the valley lands and that there has not yet been time for a detailed comparison of the effects in the valleys with those in the hills, where the buildings are founded on firm rock except in a few notable instances.

The most instructive of these instances is the city of San Francisco, and the facts observed there are entirely in harmony with the generalization above outlined. In the city of San Francisco we may recognize for preliminary purposes four types of ground: (1) The rocky hill slopes; (2) the valleys between the spurs of the hills which have been filled in slowly by natural processes; (3) the sand dunes; (4) the artificially filled land on the fringe of the city. Throughout the city we have a graded scale of intensity of destructive effects which corresponds closely to this classification of the ground. The most violent destruction of buildings, as everybody knows, was on the made ground. This ground seems to have behaved during the earthquake very much in the same way as jelly in a bowl, or as a semi-liquid material in a tank. The earth waves which pass through the highly elastic rocks swiftly with a small amplitude seem in this material to have been transformed into slow undulations of great amplitude which were excessively destructive. The filled-in material and the swampy foundation upon which it rests behaved, in other words, as a mass superimposed upon the earth's surface, rather than as a part of the elastic crust itself. In a less degree the same thing is true of the sand-dune areas, where the ground was frequently deformed and fissured. In still less degree the naturally filled valleys between the hill spurs were susceptible to this kind of movement, and the destruction of buildings was correspondingly less, but still severe, depending very largely on the character of the buildings, the integrity of their construction, etc. In portions of these valleys, however, the original surface of the ground has been modified by grading and filling, and on the filled areas the destruction was more thorough than elsewhere in the same valley tracts. On the rocky slopes and ridge tops, where, for the most part, the vibration communicated to buildings was that of the elastic underlying rocks, the destruction was at a minimum. On some of the hills chimneys fell very generally and walls were cracked; on others even the chimneys withstood the shock.

While this correlation of intensity of destructive effect appears to hold as a generalization, there are well-known exceptions which find their explanation in the strength of the structures. Modern class A steel structures with deep foundations appear to have been relatively passive, while the made ground in their immediate vicinity was profoundly disturbed. Thoroughly bonded and well-cemented brick structures, on similarly deep and solid foundations, seem to have been equally competent to withstand the shock, except for occasional pier-like walls not well tied to the rest of the building. The weak points in wooden frame structures were in general the faulty underpinning and lack of bracing, and chimneys entirely unadapted to resist such shocks. With these faults corrected, frame buildings of honest construction would suffer little damage beyond cracking of plaster in such a shock as the 18th of April, save on the made ground, where deep foundations and large mass appear to be essential for the necessary degree of passivity.

Pipe lines and bridges crossing the rift line present a peculiar, if not quite unique, engineering problem which will doubless be solved in the near future. Pipe lines on low swampy ground or in made ground are in much greater danger of destruction from earthquake shocks than those on high ground underlaid by rock, except in the immediate vicinity of the rift, where nothing could be constructed which would withstand the violence of the earth movement.

One of the lessons of the earthquake which seems peculiarly impressive is the necessity for studying carefully the site of proposed costly public buildings where large numbers of people are likely to be congregated. In so far as possible such sites should be selected on slopes upon which sound rock foundation can be reached. It is probably in large measure due to the fact of their having such a rock foundation that the buildings of the State University, at Berkeley, escaped practically uninjured. The construction of such buildings as our public schools demands the most earnest attention of the people and of the authorities charged with their construction. A great many of our schools proved to be of flimsy construction and ill adapted to meet the emergency of an earthquake shock of even less severity than that of the 18th of April.

The Commission, in presenting this brief report, has had in mind the demand on the part of the people of the State and of the world at large for reliable information as to the essential facts of the earthquake. It has, therefore, not presumed to engage in any discussion of the more abstruse geological questions which the event naturally raises. It leaves such discussion for a more exhaustive report, which can only be prepared after the campaign of data collection is complete, and that may be some months hence.

Very respectfully submitted in behalf of the Commission,

Andrew C. Lawson,
Chairman.

A. O. Leuschner,
Secretary.

EUROPE.

The New Map of Paris.—A letter to the Society from Paris says that the Service Géographique de l'Armée, to which is entrusted the entire topographic survey work of the country, is making excellent progress with the new map of France in eight or nine colours which is being published on the scale of 1:50,000, or 0.7 statute mile to an inch. The sheets thus far issued are very fine specimens of cartographic art. The Paris sheet has just been completed, and was about to be placed on the market.

All who are interested in this new map should read the detailed articles upon it published in the *Annales de Géographie* in March, 1904, by Prof. Vidal de la Blache, and in May, 1905, by Mr. Emm. de Margerie. The first article is accompanied by a specimen sheet of l'Isle-Adam; the second has a map showing the progress of the work. Nine sheets of the environs of Paris were published last year. The surveys are being conducted in the field on a scale of

1:10,000 in regions of moderate relief and of 1:20,000 in mountainous regions. Surveys on these scales are to form the basis of the new cartography of France. It is probable that the next publications will be maps of the environs of the other large cities of the country. It is estimated that the cost of producing the entire map will be $6,000,000; and as the appropriations thus far voted are small, it is likely that the progress of the map will be slow.

FOUR-COLOUR PRESS FOR MAPS.—Among the comparatively new machines used in map production is a four-colour press employed in one of the largest commercial map houses in Paris, which prints a map in four colours simultaneously at one feed by a very ingenious device which prevents the rollers of the wrong colour from touching the plate.

NINTH INTERNATIONAL GEOGRAPHICAL CONGRESS (GENEVA).—The Committee on Organization held a meeting on the 2nd of June.

Three Honorary Presidents have been named: The President of the Swiss Confederation, in office in 1908; the President of the Council of State of Geneva, for the same year; and H. M. the King of Rumania.

The list of Honorary Vice-Presidents includes the four surviving Presidents of previous International Geographical Congresses.

The Circular of Invitation and the text of the General Preliminary Arrangements will be published in November next.

A MAGAZINE FOR GLACIOLOGY.—The news and literature of most of the earth-studies reach the interested public through journals or bulletins that are devoted to these specialities. Glaciology, however, has been without an organ, in spite of its growing literature and the many specialists who for some decades have given much attention to it. This lack is supplied at last by the appearance of the *Zeitschrift für Gletscherkunde, für Eiszeitforschung, und Geschichte des Klimas.* The first number (May, 1906) is a handsome magazine of 80 pp. Dr. Eduard Brückner, Professor of Geography at the University of Halle on the Saale, is the editor, and the publication is the organ of the International Glacier Commission, with Professors Forel, J. Geikie, Nansen, Penck, and H. F. Reid, Mr. Charles Rabot, and other well-known geologists and glaciologists associated in the management. The magazine, which is to appear at intervals, with from four to five numbers in a volume, is priced at 16 marks per volume, and is handsomely printed in large type, with a number of diagrams and half-tone photographs. Four leading articles occupy, with an introductory announcement by the editor, 60 pages, a department of news, notes, and minor contributions 10 pages, and there are five pages of concise book reviews, and a bibliography, in which it is expected to cover the literature of glaciology and historical climatology, beginning with 1905. These departments will appear in every number.

Two of the leading articles are in German, one in French, and one in English, the latter being by Prof. J. Geikie, on "Late Quaternary Formations of Scotland," in which he presents new evidence for the accuracy of his belief that the formations which in the British Islands are classed as "Postglacial" afford striking evidence of climatic oscillations and that these formations cannot be separated from the glacial series.

One of the most striking illustrations is a view of the Antarctic inland ice as seen from the Gaussberg. It accompanies a long note by Dr. Drygalski on the movement of the Antarctic inland ice, in which he says that in King William II.

Land the inland ice, at the point of observation, was moving to the sea at the rate of 50 meters in five months, or about a third of a meter a day; he contrasts this with the movement of 18 meters a day of a Greenland ice stream between rock walls, while the former is a movement of ice over a comparatively even surface.

This new publication makes a decidedly favourable impression as a scientific journal of high rank, carefully edited, and produced in the best manner.

OCEANOGRAPHY.

DRIFTS IN THE PACIFIC OCEAN.—For a number of years the Government of New South Wales has been distributing to shipmasters trading to Sydney printed papers to be enclosed in bottles and thrown overboard. A considerable number of these blank forms, filled out by those who cast them into the sea or who recovered them, has been returned to Sydney. Mr. H. A. Lenehan publishes in the *Journal and Proceedings* of the Royal Society of New South Wales for 1904 the latest of a series of eight papers on these drift returns. Several valuable returns are recorded, the most interesting of which relates to a paper that was cast adrift within a few miles of the California coast, probably just outside the influence of the coastal inset, and travelled a distance of 11,350 miles, nearly half circumnavigating the globe before reaching its terminal point on the island of Boillon in the Java Sea. It is the first record received of drift in that part of the North Pacific Ocean. It is supposed that when the paper was put overboard on July 19, 1901, winds were blowing off the land and so drove it into the great North Pacific drift. It was carried to the south, and thence along to the westward, in latitudes between 0° and 20° N., when it probably got into the north equatorial current. From thence it passed through Malacca Straits to the spot where it was discovered.

Another paper had both a long and rapid drift. It was put into the sea a few degrees south of the equator in long. 88° 47′ E. and threaded its way through Torres Strait to the Solomon Islands, passing through a veritable network of reefs and islands. The drift was 4,830 miles at a daily rate of 21.6 miles, the fastest recorded. Six papers from the Indian Ocean have been found on the coast of Africa, five of which followed well-known courses; but one, which from what is known of the drifts might be supposed to be destined for the coast of Cape Colony, was picked up at Mombasa.

In the Atlantic Ocean, three papers thrown overboard in the Bay of Biscay, south of the Canary Islands and west of St. Helena, respectively, found their way to the West Indies, the drift farthest north being the slowest and the one south of the equator the fastest. There were several important records from the Southern Ocean, some of the papers reaching the Australian coast, one making its way to the north of New Zealand near Kaipara Heads and another to Aneiteum, New Hebrides. The fastest drift was 9.7 miles a day and the slowest at a daily rate of 1.4 miles. Some anomalies were found in the Great Australian Bight, where the charts show that the drift is to the eastward; yet three of the papers had a noteworthy westerly set.

THE EARLIEST ITALIAN PUBLICATION ON OCEANOGRAPHY is, according to Roberto Almagia, the *Relatione del Mare,* written by Giovanni Botero and printed at Rome in 1599. A short but comprehensive (for its time) treatise of what was then known or believed to be known concerning the sea and its relations to the land and the atmosphere, including the tides, which Botero says are generally believed to be due to the moon. A number of other phenomena related to the ocean are discussed in the little treatise, which the critic describes with care, impartiality, and adequate knowledge of the subject.—(*Bollettino della Società geografica Italiana,* Serie IV, Vol. VII, 4. April 1906, *Communicazioni e Relazioni.*)

OCEANOGRAPHICAL MUSEUMS.—*The Geographical Journal* (June, 1906) says that the Prince of Monaco has decided to transfer to Paris the Oceanographical Institute founded by him at Monaco, and has set apart the sum of $800,000 for its maintenance, besides endowing it with the Museum established by him and all the scientific appliances connected with it. The management of the Institute, which will be placed on ground acquired with the Prince's aid by the University of Paris, will be vested in an international committee of specialists.

AN OCEANOGRAPHICAL MUSEUM has also been established in Berlin in connection with the Institut für Meereskunde. It was opened on March 5. The Museum is divided into four sections: (1) A collection illustrating the Imperial Navy, containing pictures and models of warships, and specimens of guns, torpedoes, etc.; (2) a popular and historical collection illustrating the progress of navigation, with models of modern and primitive vessels, life-saving apparatus, etc.; (3) a collection of instruments, etc., used in the study of the ocean and its contents, with numerous models showing the height of the continents and the depths of the ocean, the weight and volume of land and sea respectively in relation to those of the whole earth, the amount of salt in the sea, etc.; (4) a collection illustrating the biology of the ocean and the fisheries, with examples of the products of economic value.

INSTRUCTION IN OCEAN RESEARCH.—The Oceanographical Institute of Bergen Museum announces that courses in ocean research will be held, as last year, in Bergen, Norway, during the university vacation from Aug. 8 to Oct. 15. The courses will consist partly of lectures, partly of practical instruction and assistance in laboratory work. During the excursions the use of appliances and instruments will be demonstrated. The lectures are so arranged that all may be attended by students who desire to do so. Dr. A. Appellöf will lead examinations of forms of the fish and invertebrate animals in the fiords and North and Norwegian Seas, lecture on the distribution of bottom fauna, and conduct excursions in the adjacent fiords. Dr. D. Damas will have charge of animal plankton and ordinary plankton biology and Mr. E. Jörgensen of plankton algæ. Mr. B. Heland-Hansen will give instruction on methods of oceanographic investigations, review the results of researches in north European waters, and lecture on theoretical oceanography. Docent C. F. Kolderup will lecture on ocean-bottom deposits and glacial and post-glacial deposits in Norway. Those who wish further information should write to the Institute at Bergen.

POLAR.

CAPTAIN MIKKELSEN'S EXPEDITION.—A letter from Captain Mikkelsen, dated June 23, announces the arrival of his Arctic party at Dutch Harbour, Unalaska Island, at the entrance to Bering Sea. On the way north the party spent ten days at Kadiak Island. The ship which Captain Mikkelsen purchased has given much satisfaction, as she is a fine sea boat and easily handled. At the time of writing, Captain Mikkelsen expected to go north to Cape Deshnef, Siberia, to purchase dogs and then to go to Nome, from which place he hoped to sail for the Arctic Ocean on or about July 25.

THE PRINCE OF MONACO IN ARCTIC WATERS.—The Prince of Monaco left the Mediterranean on his yacht, *Princesse Alice*, on June 20, to spend considerable time in researches in and near Spitsbergen. His studies will include the sea depths, the upper air, and the interior of Spitsbergen, He will investigate the upper atmosphere by means of balloons, as in his experiments in the region of the northeast trades last summer, and will also send one or more parties to explore the interior of Spitsbergen.

NEW MAPS.

AFRICA.

EGYPT.—Egypt. Scale, 1:50,000, or 0.7 statute mile to an inch. Sheets: I–I N.W.; I–II S.E.; II–I S.E.; II–II S.E.; III–II S.E.; XXIV–VII S. E.; XXIX–VIII S.E. Survey Department, Cairo, 1906,

These are the first sheets of the topographical map of Egypt on a scale of 1:50,000 which the Survey Department has just begun to publish. They delineate regions along or near the Nile in the Mudirias of Giza, Qena, and Aswan. The sheets within the map borders are 18 by 20 inches. The hydrography, including the canals, is in blue, the names and all cultural features, excepting the canals, are black, and the desert areas white. The information is detailed and very clearly expressed. The Mudiria and Markaz boundaries, canals, villages, banks, roads, and bench marks are given. The nomenclature is both in English and Arabic. The new map will be a great addition to the cartography of Egypt.

GERMAN SOUTHWEST AFRICA.—Farm Übersichtkarte von Teilen der Bezirke Windhuk und Karibib. Scale, 1:200,000, or 3.1 statute miles to an inch. Prepared in the Imperial Land Survey Office, Windhuk. *Mitteil. v. Forschungsreis. u. Gelehrt. aus den Deutsch. Schutzgeb.*, Vol. 19, No. 2, Berlin, 1906.

These land holdings are devoted almost wholly to grazing, and many have an area of thirty to forty square miles. The names of the farms and the farm boundaries are distinguished by green, watercourses in blue, topography in brown, and elevations in figures.

TOGO.—Karte von Togo. Scale, 1:200,000, or 3.1 statute miles to an inch. (D1, Kete-Kratschi.) *Mitteil. v. Forschungsreis. u. Gelehrt. aus den Deutsch. Schutzgeb.* Vol. 19, No. 2, Berlin, 1906.

Another sheet of the map of Togo. It gives much detail concerning large districts, but shows that the courses of many tributaries of the Volta River have not yet been learned, excepting where roads cross them. The roads connecting white stations, projected roads, native paths, official and mission stations, fords and bridges, and much other information are given.

TRANSVAAL COLONY.—Map to illustrate the Physical Features of the Transvaal. Scale, 1:300,000, or 47.35 statute miles to an inch. By Tudor G. Trevor. *Geog. Jour.*, July, 1906, London.

Some physical maps of Africa have failed to give a clear idea of the areal extent of the three distinctive divisions of the country according to elevation: the High, Middle and Low Veld and the slopes. This map differentiates them by brown tints, marks the edge of the escarpment that partly surrounds the High Veld, and gives two profiles through the Transvaal from south to north and from west to east. In his accompanying article Mr. Trevor includes the High and Middle Veld in the plateau region and marks as the slopes those areas that lead up from the Low Veld to the plateau. He estimates that the plateau country occupies 32.4, the slopes 23, and the Low Veld 44.6 per cent of the Transvaal surface.

AMERICA.

U. S. GEOLOGICAL SURVEY MAPS.

Geologic Atlas of the United States, Washington, D. C., 1906. No. 134. Beaver Folio, Pennsylvania. Scale, 1:62,500. This quadrangle forms a part of the Appalachian province. Its western boundary is about 1 mile from the Ohio State line. Bituminous coal is an important resource.

No. 136, St. Mary's Folio, Maryland-Virginia. Scale, 1:125,000. The entire width of Chesapeake Bay, with the adjoining shores of Maryland and about 1 square mile of Virginia, are included in the quadrangle, which forms a part of the Atlantic Coastal Plain province. The economic products are clays and road materials.

No. 137, Dover Folio, Delaware-Maryland-New Jersey. Scale, 1:125,000. A part of the Atlantic Coastal Plain province occupying the northern part of the long peninsula which extends from the headwaters of Chesapeake and Delaware Bays to Cape Charles.

No. 138, Redding Folio, California. Scale, 1:125,000. Includes a little less than one-fourth of the area of Shasta Co. in northern California. This county has long been known for its mineral products, copper, gold and silver being most important. The larger part of the mineral values of the county now comes from this quadrangle or near its borders.

U. S. HYDROGRAPHIC OFFICE CHARTS.

Pilot Chart of the North Pacific Ocean, August, 1906.

The reverse has a chart showing the track of typhoons in East Asiatic waters. The velocity along the track in low latitudes is about 17 miles an hour; in middle latitudes, 5 to 10 miles an hour; in high latitudes, 20 to 30 miles an hour.

ALASKA.—Geologic Sketch Map of the Rampart Region, Alaska. Approximate scale, 16 statute miles to an inch. By L. M. Prindle and F. L. Hess. *Bull.* No. 280, U. S. Geol. Survey, Washington, 1906.

The Rampart region is one of the four important gold-producing districts of the Yukon-Tanana district. This map, while only approximately correct, represents with fair accuracy the general relations of the narrow belt of country which it includes to the larger area of which it is a part.

ASIA.

CHINA.—Postal Map of China, 1905. With insets of the Newchwang and part of the Canton districts. *Returns of Trade*, 1905, Imperial Maritime Customs, Shanghai, 1906.

Shows in colours the post offices, limits of postal districts, and postal connections by courier, steamer or launch, and railways. Among the 37 postal districts there are a dozen as large as most countries in Europe. Only a beginning has yet been made in developing the postal service; but this convenience has taken hold of the people, and its prospects are most encouraging.

EUROPE.

GERMANY.—Hafenanlagen in Bremen. Scale, 1:5,000, or 0.07 statute mile to an inch. Deputation für Häfen und Eisenbahnen zu Bremen, Bremen, 1905.

GERMANY.—Hafenanlagen in Bremerhaven. Scale, 1:5,000, or 0.07 statute mile to an inch. Deputation für Häfen und Eisenbahnen zu Bremen, Bremen, 1905.

The large scale of these maps, in colours, of the harbours of Bremen and its outport Bremerhaven make it possible to present the detailed plans of the two ports very clearly. All the dockage and basins, with railroad connections, are shown, and the Bremerhaven sheet has an inset giving the tonnage each basin will accommodate, and its depth at high and low water. The harbours, shipping, commerce tributary to them, and the free ports are described in the accompanying letterpress.

ICELAND.—Carte de l'Île Islande. Scale: 50,000, or 0.7 statute mile to an inch. Sheets: 49 N. E. Vestmannaeyjar; 59 N. E. Portland; 68 S. E. Skaptártunga; 69 N. E., N. W., Hjörleifshöfdi; 77 S. E. Lómagnúpur; 78 N. E., N. W., S. E., S. W., Kirkjubaejarklaustur; 79 N. W., Grimsstadir; 87 N. E., N. W., S. E., S. W., Oraefajökull; 88 N. E., N. W., Ingólfshöfdi; 96 S. E., Heinaberg; 97 N. E., N. W., S. W., Kálfafelsstadur; 106 S. W. Lon-Nàgrenni Reykjavikur og Hafnarfjardar. Scale: 1:25,000, or 0.3 statute mile to an inch. Reykjavik. Scale: 1:5,000, or 0.7 statute mile to an inch. Hafnarfjördur. Scale: 1:5000. Presented by the Topographic Section, Copenhagen, 1906. (Price, 1 crown per sheet.)

A detailed survey of Iceland was begun in 1902, and these sheets are based upon that survey, which, thus far, has embraced only areas contiguous to the south coast, Reykjavik, Hafnarfjördur and their environs on the west coast, and the Westmann Islands. The funds have been supplied jointly by the Danish and Icelandic Governments, and it is hoped that the survey will be continued. It is expected to issue the map on the scales of 1:50,000 and 1:100,000. The map of the whole island on the latter scale will comprise 115 sheets, and on the larger scale, which is that of the sheets thus far issued, the number of sheets will be 460. The sheets are finely produced and the scales permit a large amount of detail from plans of the towns to paths, farm boundaries, cultivated fields, pastures, and water mills. The contour interval is 20 meters, the glacial as well as the land slopes are shown, and the plan of Reykjavik names the streets and all important places, and shows in red every building in the city.

SAXONY.—Volksdichte-Schichtenkarte des Königreiches Sachsen, nach der Zählung von 1 Dezember 1900. Scale, 1:528,000, or 8.3 statute miles to an inch. By H. Wiechel. Supplement to the *Zeitschrift* of the Royal Saxon Statistical Bureau, 1904.

Colours and contours are ingeniously used to show various densities of population, much as they are used by photographers to show differences of elevation. Thus the distribution of population is denoted in a more scientific and detailed manner than on the ordinary density-of-population map.

SCOTLAND.—Répartition Géographique des grandes Associations végétales dans les Highlands d'Ecosse. Scale, 1:633,600 or 10 statute miles to an inch. By Marcel Hardy. *Annales de Géog.*, No. 81, Paris, 1906.

Illustrates an article by Mr. Hardy on the vegetation of the Scottish Highlands. The map is by Bartholomew, and shows by tints the distribution of cultivation, dunes, heath, moor, pasturage, Alpine areas and rock ridges, and the oak, birch, and coniferous forests.

EAST INDIES ARCHIPELAGO.

THE PHILIPPINES.—Manila. Plan of Proposed Improvements. Accompanies Report to the Secretary of War, 1905.

This is a black-and-white map illustrating the proposed improvements described in the report by architects Burnham and Anderson. The map shows the proposed development of water front and the distribution of parks and parkways by which it is expected to supply adequate means of recreation to every quarter of the city; also the sites selected for future public buildings and the projects for the improvement of waterways. Another plan in the same report shows the proposed sea boulevard in Manila bay. It is to be a wide, splendid thoroughfare along the shore of the bay from Manila to Cavité.

THE PHILIPPINES.—Map of Batan Island. Scale, 1:100,000, or 1.5 statute miles to an inch. Coast and Geodetic Survey of the Philippines, 1903.

Illustrates Lieutenant Wigmore's report on the examination of coal deposits in Batan Island. The position of the outcrops is indicated.

ATLASES.

ATLAS OF THE WORLD'S COMMERCE.—Compiled from the latest Official Returns at the Edinburgh Geographical Institute. Edited by J. G. Bartholomew. (Part 6.) George Newnes, London, and Frederick Warne & Co., New York, 1906.

One of the two map sheets is devoted to silk, furs, and feathers, and the other to gold. The silk-and-furs map shows in purple and red tints the areas producing silk, those yielding sufficient silk for exporting, regions where the silk worm is found wild, and the areas of the sea fisheries. Scattered over the map are the names of the chief fur-bearing animals in red. This is perhaps the first time a map has been compiled to show the distribution of the feather industry. Three tints show the distribution of the eider duck, ostrich and rhea, and the names of birds whose feathers form an important article of commerce are distributed in red. Domestic birds are not included.

The gold-mining sheet shows the world distribution of the industry in red and the chief lines of export in blue. Six smaller maps show on a much larger scale the especially productive districts. All these maps are illuminative and excellent, except that entitled Alaska. The title is a misnomer, for fully nine-tenths of the gold areas shown are on the Canadian side of the border. The regions that produce nineteen-twentieths of Alaska's gold—viz., the Seward Peninsula, the Koyukuk, a part of the Tanana mining region, Cook Inlet, and the great quartz-crushing area on Douglas Island are outside the limits of the map, and the curious mistake is made of colouring a part of the Malaspina Glacier as a "Gold District." This mistake is repeated on the general map, but otherwise the distribution of Alaskan gold is shown as well as the small scale permits. The reverse of the sheets is filled with discussion, statistics, and diagrams relating to the commodities mapped. The description of the commodities of commerce is carried forward from "Leathercloth" to "Milk," with diagrams in the text.

BOOK NOTICES.

Ferguson's Ceylon Handbook and Directory, 1905-6. xi and 1364 pp. and Index. A. M. & J. Ferguson, Colombo, 1905-06. (Price, £1.)

The present edition of this excellent hand-book is, as usual, filled wtih practically every kind of information to answer all sorts of inquiries about this remarkable island. The most novel and, for the world at large, the most interesting pages in this edition are those devoted to the rubber-planting industry—for Ceylon is doing more than almost any other region to demonstrate the practicability of rubber cultivation. The frontispiece is a photograph of Pará rubber trees taken in the Government gardens at Henaratgoda. The trees have grown to large size; and though the oldest and largest of them (28 to 29 years) are not shown in the picture, it gives a good idea of the thrift of the Pará rubber tree in Ceylon.

Rubber-planting began twenty-nine years ago; but, at first, little attention was paid to Pará or Mexican rubber, as the hardy Ceará nearly monopolized attention. In recent years a great deal of interest in the Pará rubber tree (*Hevea Braziliensis*) has developed. Until 1898 rubber-planting was represented by only about 750 acres; but by the middle of 1901 the acreage was about 2,500, and in June, 1904, there were 11,000 acres. Planting has gone on with remarkable rapidity during the past year, and the estate returns show nearly 40,000 acres. It was at first estimated that not more than 10,000 acres in Ceylon would be available for Pará rubber, but it is now known that the range will be much more extensive. In 1903 the tree was flourishing at a height of over 3,000 feet, and it is now doing well up to 4,000 feet. The crop of 1893 was 2,792 pounds. It kept increasing every year, till in 1904 it was 77,212 pounds. The crop of half of 1905 was 51,520 pounds.

John Chinaman at Home. Sketches of Men, Manners and Things in China. By the Rev. E. J. Hardy. 335 pp., numerous Illustrations and Index. Imported by Charles Scribner's Sons, 1906. (Price, $2.25.)

The author was a chaplain for three and a half years in the British forces at Hongkong. From time to time he was absent on leave in China, and during his sojourn in the country he observed and heard everything he could about the habits and customs of the people. The first six chapters contain descriptions of some of the leading cities—Hongkong, Tientsin, Peking, Canton, Swatow, Amoy, Foochow, and of journeys on the West and Yangtse Rivers. Fully three-fourths of the book is given to the life of people, their food, medicines, clothes, houses, gardens, servants, betrothal and marriage, death and burial, boys, girls, education, manners, the Government, religions, superstitions, and other topics, including missionaries. The book is filled with incident, and the simple and interesting style in which it is written is well adapted to leave a vivid impression of the everyday life of the Chinese.

We appear to the Chinese, in all respects, to be as singular and eccentric in our customs as they have appeared to many of us. When we criticise the Chinese for worshipping their ancestors, they retort that we worship our wives. The

Chinese strongly objects to being looked at through glasses, and the native wearing spectacles who does not remove them when a visitor comes into his room would be thought very rude. The Chinese accuse us of morbid unrest; they say we do not live, because we are so intent upon increasing the means of living that we are always discontented. How can we put either milk or sugar in our tea when they destroy bouquet and flavour? The writer goes below the surface of many things Chinese, and we are not only introduced to the aspect of life among them but also learn something of the philosophy which underlies their doings and prejudices.

Heroes of Discovery in America. By Charles Morris. 344 pp., 12 Illustrations. J. B. Lippincott Company, Philadelphia, 1906. (Price, $1.35.)

Unfortunately, this book seems to have been prepared without the geographical instinct that seizes upon the most significant and vital facts and without sufficient striving after accuracy. An author who presents Robert E. Peary and Roald Amundsen, at present the most-talked-of Arctic travellers, as "Robert B. Peary" and "Roand Amundsen" has only himself to blame if his facts are thought to have been compiled with inadequate care. Such statements as this: "Amundsen forced his vessel across the Northwest Passage from the Atlantic to the Pacific" are of little value. Whereabouts was this channel he followed? For any intimation this book gives about the matter Amundsen's route might have been north instead of far south of McClure's.

The Euahlayi Tribe. A Study of Aboriginal Life in Australia. By K. Langloh Parker. With an Introduction by Andrew Lang. xxvii and 156 pp., 6 Illustrations, Glossary and Index. Archibald Constable & Company, Ltd., London, 1905. (Price, 7s. 6d.)

Mrs. Parker's contribution to the study of the manners, beliefs, and legends of the Australian aborigines is the result of her observation from childhood of the Euahlayi tribe in the northwestern part of New South Wales. She had unequalled opportunities for the study of the women and children, in which respect the male scientific observer is usually at a great disadvantage. The Australian natives are regarded "as the most backward of mankind, having no agriculture, no domestic animals, and no knowledge of metal-working. Their weapons and implements are of wood, stone, and bone, and they have not even the rudest kind of pottery. But though the natives are all, in their natural state, on or about this common low level, their customary laws, ceremonials, and beliefs are rich in variety."

None of Mrs. Parker's informants had ever been under the influence of missionaries, and yet these primitive people, in a limited and modified form, hold a belief in reincarnation, and have other ideas and usages that are deserving of close study. Mrs. Parker's intimate acquaintance with them gave her a great advantage in collecting their legends. She says that if the inquiring white is a stranger a legend will be told him as quickly as possible, and in a half-contemptuous way, as much as to say, "What do you want to know such rubbish for?" But if the native *raconteur* knows the visitor well, and feels that he is really interested, the stories will be told as he would tell them to his family, giving them a new life and adding considerably to their poetical expression.

Mrs. Parker has some unusual advice for missionaries. She believes that before they go out to teach they should acquaint themselves with the making of the world's religions and particularly with the one they are going to supplant. They will probably find that elimination of some savagery is all that is required, leaving enough good to form a workable religion that will be understood by their barbarous pupils:

> If the missionary ignores their faith, thrusting his own, with its mysteries which puzzle even theologians, upon them, they will be but as whited sepulchres or, at best, parrots.

Old Maps and Map Makers of Scotland. By John E. Shearer. viii and 86 pp., Illustrations, Maps and Index. R. S. Shearer & Son, Stirling, 1905. (Price, 10s.)

This handsome volume describes a large number of maps of Scotland from the time of Strabo, about 20 B.C. to 1832. Strabo was the first to map that region; but he showed it as an island—a mistake that was committed by many later map-makers. Ptolemy's map of 150 A.D. did not show Scotland as a separate island, but this mistake was very common on maps of the thirteenth, fourteenth and fifteenth centuries. The author produces, chiefly on a small scale, twelve of the early maps, the most important of which are those of Ortelius in 1570 and Robert Gordon in 1653. The map published by Ortelius was the first printed map of Scotland.

Chronicles of London. Edited with Introduction and Notes by Charles L. Kingsford. xlviii and 368 pp., Appendix and Index. Clarendon Press, Oxford, 1905. (Price, 10s. 6d.)

The introduction contains an account of the various Chronicles of London which were compiled by aldermen or other citizens from about the twelfth century and gradually lengthened and became more important in the following centuries. Together they cover a period of 320 years—from 1189 to 1509. This book contains the most detailed account of the Chronicles yet printed and the text of three of them. The critical and explanatory text is very full, and the Chronicles are now presented to historical students in convenient and edifying form. The Notes deal chiefly with matters illustrating the history of London or the text of the Chronicles, and the Glossary explains archaic or obsolete words and those that are used in an uncommon way. These three Chronicles are typical specimens of the English language in a transition state, and illustrate its progressive development from archaic passages in the Cleopatra Chronicle to the most modern part of Vitellius, written in the opening years of the sixteenth century. A photographic reproduction of Ryther's map of 1604, one of the oldest plans of the city, forms the frontispiece.

La France. Par P. Vidal de la Blache et P. Camena d'Almeida. (Eighth Edition.) xxx and 543 pp., 23 Maps and Index. Armand Colin, Paris, 1905. (Price, 3.25 fr.)

A school book that was in its sixth edition in 1904 and reached its eighth in the following year evidently fills a need. The book differs much from our geographical text-books, and is more like our geographical readers, excepting that there is no special effort to "write down" to the level of the grammar grades. The forms of the land, hydrography, climate, industries, settlements, etc., in each geographical division are fused, as it were, into a well-compacted narrative with a kind of rounding off of the abrupt transitions which make so many text books very dull. At the end of each chapter is a "revision" or summary of its main features. The colonies are also described, and a chapter is given to the military organization, the defence of the frontiers, and the routes leading to them.

Round the World Geographical Readers. Europe. By W. Vere Mingard. 295 pp., Illustrations and Maps. T. C. & E. C. Jack, London, [undated]. (Price, 1s. 6d.)

Emphasizes the chief geographical features of each country, and then simply describes the industries and most important towns. The plan of the book and its literary execution are to be commended for young readers. But the two introductory paragraphs are really unfortunate. The author says that while America contains loftier mountains, longer rivers, and larger lakes, yet it cannot compare with Europe in importance. Then he sets forth the reason why:

> The influence of mountains, rivers, coast-line, climate, character of the soil and many other natural conditions cannot be set aside; but far before these are the habits, skill and enterprise of the people who inhabit the country. Of what avail are fine bays, fertile soil, precious minerals and other advantages to men who do not know how to use them?

Europeans usually credit us with knowing how to use the natural advantages we possess.

Between Capetown and Loanda. A Record of Two Journeys in South West Africa. By Alan G. S. Gibson. xvi and 203 pp., 20 Illustrations, Appendix and Map. Wells, Gardner, Darton & Co., Ltd., London, 1905. (Price, 3s. 6d.)

The book has some geographical value for the glimpses it gives of development and conditions of settlement in southwest Africa, from the sandy plains of Cape Colony to Humpata, the chief Boer settlement in southern Angola, and at the three important ports of that Portuguese colony. Bishop Gibson's chief purposes were to visit the scattered families belonging to the English Church and to look for missionary opportunities among the native races; and most of his book is given to these topics. The first journey was made in 1901 and the second in the following year. He says that the Cape Mounted Police are now using camels for patrolling in the sand country of Cape Colony. He was much interested in comparing the language of the Ovaherero (who after his visit waged a long and desperate war with the Germans in German South West Africa) with those spoken by the Kafir tribes in the east of Cape Colony. He found that some words in their various languages are almost the same, and he suggests that any one who really masters any Bantu language may, without great difficulty, acquire any other of the same family. Windhoek, the capital of German South West Africa, owes its origin to the springs that fertilize the surrounding country, and he found it attractive with its hills, trees, pretty gardens, and good buildings. Humpata is the centre of the Boer life in southern Angola, and is the outcome of the famous trek of Transvaal Boers in 1875-1880. About 1,000 Boers are now living on this Huilla plateau, some 6,000 feet above the sea, where they raise fine field crops and fruit and have abundant pasturage. The two great drawbacks are the lack of a market and the diseases which affect cattle and horses.

By-Paths in the Balkans. By W. V. Herbert. xiii and 269 pp., Glossary and Index. Chapman & Hall, Ltd., London, 1906. (Price, 10s. 6d.)

A collection of impressions and incidents during the author's sixteen months' journey in Balkan countries in 1903-5. His travels were chiefly in Bulgaria, Rumania, and Servia, though he spent some time in adjacent lands. He was brought into rather close relations with the common people, and, in fact, when his money gave out, he worked for a time in a restaurant, and had other opportunities for coming into touch with everyday life. He naturally saw, heard, and felt many things that are outside the experience of the ordinary traveller, and the result is that his book contains much that is new about regions that have not yet been written to death.

Captain Herbert says that maize, wheat, and vineyards now cover the battlefield of Plevna, where about 100,000 soldiers sleep their last sleep. The chapters on the Gypsies, who are more in evidence in the Balkans than in any other land, are very informing. There are about 700,000 of them in the European Orient, and at least 250,000 are habitual nomads. The districts reserved for them in towns and cities are called *mahallahs,* which are always composed of dirty hovels in narrow, crooked lanes. Constantinople has several mahallahs, with an aggregate population of 10,000. The largest in Bulgaria, at Sofia, contains 3,000 souls, and that at Plevna 2,500. The Gypsy professes ostentatiously the religious faith of the country in which he happens to reside or travel, and so the nomadic families are likely to change from Islam to Greek Christianity and *vice versâ* a dozen times in the year. The Gypsy is considered by Christian, Jew, and Mohammedan as an unclean outcast, with the result that he has no social relations with other peoples and has remained pure in race. These people have no education, but every large band usually has one person who can read and write Turkish and acts as professional letter-writer.

Benares the Sacred City. Sketches of Hindu Life and Religion. By E. B. Havell. xiii and 236 pp., and 79 Illustrations. Blackie & Son, Ltd., London, 1905. (Price, 12s. 6d.)

The second half of the book is given to a description of Benares and of its environment, especially along the banks of the Ganges. The purpose of the author is not mere description, but to convey to the reader an adequate conception of the religious ideas and beliefs which millions of East Indians associate with this city. Benares was the birth-place both of Buddhism and Brahminism, and, as the writer says, the imaginative and artistic side of the Indian religions can be observed in few places so well as in this sacred city and its neighbourhood. For this reason Benares is very prominent in the author's clear and intelligible outline of Hindu ideas and religious practices.

Wirtschaftsgeographie. Mit eingehender Berücksichtigung Deutschlands. Von Dr. Christian Gruber. x and 235 pp., 12 diagrams and 5 maps. B. G. Teubner, Leipzig, 1905. (Price, M. 2.40.)

This is a practical text-book on economic geography. Its author has taught the subject in Munich for nineteen years. It closely connects cause and effect, and in this respect is in advance of nearly every other German text-book on the subject. An outline of the chapter on Austria-Hungary will give an idea of Dr. Gruber's method of treatment. He first considers the influence of the empire's geographical position in Europe upon its industrial conditions. Then he treats of the influence upon trade exerted by the shape of the empire and by the conditions along its boundaries, giving many illustrations, as, for example, two rivers, the Elbe and the Danube, both of which cross the frontier, one of them providing a cheap freight route between Austria and north Germany and the other between Austria and South Germany. The empire is next studied as a land of sharp geographical contrasts, and the influences of these contrasts, of mountain and plain, these differences in climate, etc., are indicated. The next section deals with the importance of the empire, the adequacy of its communications, and the distribution and nature of its commerce; and, finally, the author considers the natural industrial divisions of the country—the Alpine lands (including the eastern Alps and a large part of Austria), the Karst lands (Carniola, Croatia, Slavonia, Dalmatia, Herzegovina), the Sudetic lands (Bohemia, Moravia, and Austrian Silesia), and the Carpathian lands (Hungary, Galicia, and Bukovina), showing the characteristics of production and trade in each of these regions.

About half the book is given to the German empire, the other European states also having considerable space, while the rest of the world is rather summarily treated. The book does not pretend to deal with all the phases of the subject; for example, there is no section devoted to the description of commercial commodities, but as far as it goes it is one of the most suggestive, helpful, and interesting text-books yet written in this department of geography.

Fasciculi Malayenses. Anthropological and Zoological Results of an Expedition to Perak and the Siamese Malay States, 1901-1902. Undertaken by Nelson Annandale and Herbert C. Robinson, under the Auspices of the University of Edinburgh and the University of Liverpool. Zoology. Part I. Published for the University Press of Liverpool by Longmans, Green and Co., 39 Paternoster Row, London, New York and Bombay, 1903. 4to, ll. 5, pp. 1–200, pll. i–x.—Mammals by J. Lewis Bonhote, M.A., F.Z.S. Pp. 1–45, pll. i–iv. Batrachians and Reptiles, by G. A. Boulenger, F.R.S. Pp. 127–176, pll. v–x.

Mr. Bonhote's "Report on the Mammals" of this important expedition is a most valuable contribution to the Mammalogy of the Malay Peninsula. The collection, as worked out by Mr. Bonhote, numbers 64 species, of which 8 are described as new; nearly a dozen others, mostly doubtfully identified, are mentioned, on the basis of the collectors' field notes. The 64 species represented by specimens include 3 monkeys, 1 lemur, 10 carnivores, 4 insectivores, 16 bats, 11 squirrels, 10 rats, 2 porcupines, 1 antelope, 4 deer, 1 pig, 1 porpoise, and 1 pangolin. This is a very good showing, considering that the collecting of mammals was incidental to the general work of the expedition. The collector's field notes on the habits and distribution of the species add greatly to the value of the report. In working out the species of *Mus*, Mr. Bonhote found it necessary to examine, as far as possible, all the rats of the Oriental region, and he has incorporated the results in the present paper (pp. 32–38), for the benefit of future investigators of this difficult genus. He gives a synopsis of the species, dividing them into seven groups and three additional subgroups, four of which, for practical purposes, are "of almost generic value, although showing no characters of sufficient importance to enable them to be generically separated." A list of nearly one hundred species, with their places of occurrence, follows, and some further distinguishing characters for many of the groups and species. The four excellent plates contain colored illustrations of *Sciurus robinsoni* (pl. i), *Mus jalorensis* and *M. griseiventer* (pl. ii), the skull of *Hystrix grotei* (pl. iii), and the skulls of five species of *Mus* and two species of *Sciurus* (pl. iv).

Dr. Boulenger's "Report on the Batrachians and Reptiles" includes 16 species of the former (pp. 132–141, and plates v and vi) and 85 of the latter (pp. 142–176, plates vii–x), and forms a substantial addition to our knowledge of the Herpetology of the Malay Peninsula. Two species and one sub-species of frogs, two tortoises, a lizard, and a snake are described as new, whilst three additional species of lizards and one snake are here for the first time recorded from the region. Five species of frogs, two of tortoises, and three of lizards are figured in the six plates accompanying the report. There are also a few text figures. The collectors' valuable field notes constitute the greater part of the text. In an Appendix, Dr. Boulenger gives a "List of the Batrachians and Reptiles Recorded from the Malay Peninsula, South of Tenasserim." The list numbers 60 species of Batrachians, of which 16 have been added since the publication of Captain S. S. Flower's list in 1899; and 178 species of Reptiles, of which 30 species have been added since 1899, or during the last four years preceding the publication of the present report. The several orders are represented as follows: Chelonia, 23; Emydosauria, 3; Lacertilia, 71; Ophidia, 81.

J. A. A.

Fasciculi Malayenses (Anthropology: Part I, 1903; Part II, 1904). Published for the University Press of Liverpool (*as above*).

The two parts of this work are composed of a series of single contributions to the ethnology of the Malayan Peninsula, chiefly descriptive in character. The bulk of the first volume is taken up with data on physical anthropology. It deals further with the primitive beliefs and customs of the Patani fishermen, and with religion and magic among the Malays of the Patani States, the latter subject being continued in the second part. In this part Henry Balfour gives a report on a collection of musical instruments from the Siamese Malay States and Perak; besides this, some customs of the Malay-Siamese, and skeletons of the same people, are there discussed. A supplement gives a description of the itinerary of the expedition, which is accompanied by a map. In the first article of the first volume are contained a number of very interesting illustrations of decorative patterns, some with brief explanations of the ornaments and with occasional references to them in the text. It would certainly be very desirable if a special investigation of this promising subject could be carried on by the authors.

B. L.

Militärgeographie der Schweiz, nebst kurzen Schilderung der Entstehung der Neutralität Savoyens und historischen Notizen über verschiedene Alpenpässe bearbeitet von Major Frölich. Pp. II–120. Aarau, H. R. Sauerländer & Co. 1906.

Written specially for the use of Swiss officers and subaltern officers.—In the Preface the author makes the somewhat surprising statement that instruction in "home geography" is very deficient in Swiss military circles, owing to the short time allotted to officers for the purpose. There is perhaps no country in the world where national geography is so extensively and so efficiently taught as in Switzerland, where the public school pupils, male and female, are introduced to cartography at such an early age. If, however, one looks through the pages of this pamphlet (it is hardly a book, and it may be called a booklet for size and bulk), he understands the multitude and the intricacy of the problems which the military position of Switzerland presents to its eventual defenders, and justifies to some extent the complaint of the author.

Switzerland has, since its consolidation in 1847 and even before, made the detailed knowledge of its soil, from every point of view, accessible to outsiders in the most liberal manner. Conscious of its weakness in numbers, it has withheld no so-called military secrets of a geographical nature. It knows perfectly well that in case of war with any of its neighbours it will always be at a great disadvantage in certain ways. Hence there is among the Swiss hardly any boasting, and no attempt at untimely provocation. Major Froelich tends to confirm that attitude through the minute data he gives regarding the defensibility of frontiers. He shows that an offensive from the side of Italy would enjoy superior facilities of concentration and convergence, or at least parallel advances, even into the Alpine barrier, and that on the Swiss side there are difficulties in the way of rapid movements of troops in considerable numbers. Worse yet are the conditions on the western frontier in case of French aggression. France has the open country with its numerous converging railroad lines ; Switzerland has, practically, only lines that run *parallel* to its boundaries. The Jura is no barrier ; on the contrary, from the French side it is an inclined plane, facilitating invasion. On the north, Major Froelich finds a better situation. It is true that approaches from southern Germany are through a rugged country, and that rapid concentration on that front from the German side is not so easy as, for instance, on the plains of Lombardy, which abut immediately against the southern Alps. Still we cannot fully share the optimism of the author on the defensibility of the northern frontier. The German Empire remains, from a military point of view, the most dangerous neighbour. Its perfect organization, its immediate proximity on a long line interrupted by salients from the Swiss side, which must be defended, and would constitute, therefore, an incumbrance in a struggle with an overwhelming adversary—all these features counterbalance the advantages which "military" geography may present on that frontier.

Aside from highly-important allusions to a defensive warfare carried on by the Swiss on the enemy's soil—a measure which General Dufour had already prepared for in 1856 against a (then imminent) Prussian aggression—Major Froelich turns to consider the gloomy picture of a defence of Switzerland to the "last ditch." He indicates the successive interior lines of defence, and in this he commits no indiscretion. Military authorities of adjoining nations are familiar with them, and there is nothing to conceal. When he reaches the "last ditch" it is with the final query, "Shall we, then, lose heart?" To this no reply can be given in words.

We consider the booklet of Major Froelich a timely and well-inspired one. It gives warning to a small nation, thoroughly organized for defence, of dangers that might be overlooked at the wrong time. An interesting notice of the early history of Alpine passes closes this sober, modest, and geographically valuable publication.

A. F. B.

La Colonisation de la Nouvelle France. Étude sur les Origines de la Nation Canadienne Française. Par Emile Salone. xii–468 pp. Paris, E. Guilmoto (1905). (Price 7.50 fr.)

With a not very complete knowledge of all the sources available for the history of Canada under French rule, or, at least, utterly ignoring some of them, like the works of Francis Parkman, for instance, Professor Salone of the Lycée Condorcet has still written an attractive and valuable book. Coming from a specifically French source, it has a specific colour that carries with it undeniable merit. The charges of brutality and cruelty against the English in their final conquest of New France may be somewhat exaggerated, especially as towards Wolfe. War, in his time, was much more pitiless than it has since become, and due allowance should always be made for the changes wrought by progress in methods of mitigation and relief.

The history of French Canada has been written so often and by such competent writers that a new one might appear superfluous, were it not for the fact that the one before us relies exclusively upon French sources and tells, therefore, what might be called the "French side" of the tale. It shows more particularly the methods, or lack of method, pursued in France towards its North American colony, the wavering policy, the disregard for the necessities and welfare of the colonists. It is, as well known; not an attractive picture, but it is told by the author with absolute sincerity and apparent impartiality. The neglect of Canada by the home government contrasts strongly with the fortitude and heroism displayed by many of its representatives in the colony, and with the tenacity and self-sacrifice of the missionaries, among whom the Jesuits take the first place. The author omits, however, to state, what Parkman has so well shown, the great role played by the Iroquois in opposing the progress of Jesuit missions. That opposition was not consistently systematic, but it drew a boundary line which the missionaries, notwithstanding most heroic attempts, could not cross after a certain time. Had they been properly supported by the temporal power the outcome would have been different.

Towards the end of the French domination in Canada a rival arose in the more recent French settlements in Louisiana. Much more favoured by nature, this colony soon drew attention away from the cold and apparently inhospitable regions in the north. The climate of Canada always was one of the pretexts alleged in favour of abandonment. When Louisiana had become well settled and had won favour at home, the always disintegrating influence of Voltaire upon the mind of France turned openly against Canada and contributed to discredit it to a still greater extent.

The picture drawn by Professor Salone of the results of the work of education among the Canadian Indians is gloomy. Unfortunately it is true. While viewing things from afar, he still has penetrated the nature of the Indian in general, and the obstacles to his elevation *en masse* are properly recognized. Only one European nation has succeeded somewhat in raising the aborigines to a level above their primitive condition. This nation was Spain. The fact is usually denied, yet it is true. However varied the experiences of Spanish states in America have been since their independence, *there*, at least, the Indian has made some progress.

The book being historical and not geographical, accompanied by a single map and having one chapter devoted to the physical aspects of Canada, we congratulate the author on the production of a well-written and by no means indifferent contribution to the history of "northern" North America. A. F. B.

Algumas Cartas inéditas do Visconde de Santarem, com uma Introducção e Notas por Vicente Almeida d'Eça, S.S.G.L. Lisboa, 1906.*

This part of the correspondence of the distinguished Portuguese geographer and diplomat, now published for the first time, recalls the letters of Alexander von Humboldt which Ludmilla Assing published in 1860. Relations of cordial friendship existed between the two men during their lifetime, and Santarem died only two years before the great German scientist. The letters of Humboldt contain hardly anything of great value to science, whereas those of Santarem (addressed to his nephew, Count da Ponte, with the exception of two directed to Varnhagen von Ense) have more occasional bearing on geographic topics. On the subject of literature of the time when the letters of Santarem were written (1839–1852), they are fuller than the letters of Humboldt, but embrace only what has appeared in French (translations included) or other Romanic languages, whereas Humboldt includes allusions to almost any idiom then extensively printed. Of chief interest are the letters of Santarem to Varnhagen (Dec. 8th, 1839, and Jan. 31st, 1840) for their relation to the controversy about Amerigo Vespucci. Among other things Santarem proves (from the map of Juan de la Cosa) that the Island of Fernando Noronha was discovered already in 1500 by the Portuguese, not in August, 1503, as Varnhagen admitted. The tone of these two letters is rather acrimonious.

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* Published by the Sociedade de Geographia de Lisboa.

Notices of older Portuguese books, almost unknown otherwise, and of many manuscripts of interest are dispersed through the letters. They are, like those of Humboldt, intimate correspondence, and resemble them greatly in style and in tone, which is most natural, since the two distinguished men were not only close contemporaries, but belonged to the same social circles, had the same scientific traditions to follow.

A. F. B.

Lettres Américaines d'Alexandre de Humboldt. 1798–1807. Précédées d'une Notice de J.-C. Delamétherie et suivies d'un choix de documents en partie inédits. Publiées avec une Introduction et des Notes par le Dr. E. T. Hamy. xxxix and 309 pp. and Map E. Guilmoto, Paris (1905).

This collection of letters consists of sixty-three numbers, mostly printed already, but scattered through scientific publications in French, German and Spanish, and now presented in the French language for a good and valid reason. The greatest number of them are originally in French, a language which Humboldt cultivated in preference to any other on account of his close relations to the French Government and scientific institutions, as well as to French men of science. As he states in a letter to Guizot in 1826 (see Appendixes, p. 302), he enjoyed the "noble hospitality of France for eighteen years," and consequently was much attached to the country and the people, while his great earlier works, even the "*Asie centrale*," were published in the French language. To this body of letters is added a no less valuable appendix (or rather, eleven Appendixes), including an Autobiography, his "Confessions," entrusted to Pictet, and kept by the latter, and notes on Humboldt by Boussingault. In these we find the following personal description of Humboldt at the age of fifty-five (1824)—"medium height, well built, white hair, an undefinable look, a spiritual, mobile face, slightly marked by small-pox contracted at Cartagena in the Indies. His right arm was paralyzed by rheumatism, resulting from sleeping on moist leaves on the banks of the Orinoco. When he wanted to write or offer his right hand, he lifted it with his left to the height required. The costume he wore was the same as at the time of the 'Directoire': blue coat, yellow buttons, yellow vest, breeches of striped material, top boots, the only ones found at Paris in 1821, white cravat, &c., &c." His apartments were then as modest as those he occupied in the last days of his life: "a small dormitory, a bed without curtains. Where he worked, four straw chairs, a big table of pine-wood, on which he wrote. It was covered with calculations in figures and logarithms. When that table was covered with ciphers, he would send for a carpenter to plane them off. Hardly any books: the TABLES of Callet, the CONNAISSANCES DES TEMPS." At the farewell dinner given by Boussingault, Humboldt appeared in silk stockings and a new hat, and surprised everybody.

In the Introduction Dr. Hamy justly observes that the leading idea of Humboldt, from the days of his youth on, was to establish the natural philosophy ("Physique") of our globe upon a solid basis. Hence his persistence in tracing the "casual connection of phenomena," and his final work, the "KOSMOS," the only one of magnitude composed by him in German.

The "Notice of a Journey to the Tropics," by Delamétherie, which follows upon the Introduction, is a most valuable document for a knowledge of Humboldt's travels and achievements on the American continent. It was written in 1804, when Humboldt and Bonpland had just returned. Humboldt himself qualified it as "very exact," and, with the map of his American travels, it gives a very clear idea of the routes followed by him and Aimé Bonpland on the South-American continent, of his two visits to the Antilles, his journeyings in Mexico, and his visit to the United States. Thence the explorers returned to Europe after an absence of five years and two months. During that time part of the collections sent to Europe had been lost in a shipwreck; still Bonpland could, upon his return to Paris, arrange a herbarium containing six thousand species of American plants, and thirty-five boxes of collections came with the travellers, in August, 1804, to France. The manuscripts and drawings were all saved.

Turning now to the letters proper, they are certainly important corollaries to the works on America by the great German scientist. While, as Dr. Hamy intimates, they do not tell much that is absolutely new, there is a great deal in them that explains and completes. Furthermore, they give a good picture of the intellectual growth of the man during nine years of his (perhaps greatest) activity, and certainly during the period of life when youthful ardour and enthusiasm were at their height. The first of these letters was written by Humboldt when he was not yet twenty-nine (in 1798), and in it he advises Professor Pictet of Genoa of his speedy departure for Egypt in company with Lord Bristol, travelling, however, "at my own expense." It is well known how that journey was frustrated by war, and how the project (cherished by Humboldt for many years after) of reaching the East Indies met with its first check. But the letters also show that waiting was for Humboldt no time lost, for he continued his physical studies and experiments wherever he found himself. Analyses of the air, improvement of physical instruments, observations on vegetation, an extensive tour on foot along the Mediterranean and across the Pyrenees to Murcia and Aranjuez, filled up the time. He was greatly disappointed at the failure of his projected journey to India, but made up by the outcome of this pedestrian exploit, which brought him to the Court of Madrid and led to the great exploration of Spanish America, for which the Spanish Government at once furnished every facility and protection. It was at that time that Humboldt became acquainted with Aimé Bonpland, who also had been disappointed in the indefinite delay of the voyage of circumnavigation projected by the French Government. That delay was fortunate, inasmuch as it brought together two men who were so eminently fitted for joint work in the American tropics as the great physicist and the eminent botanist. From that time on Humboldt displays not only a warm admiration for his French associate, but a deep attachment, which he kept up during his lifetime and of which his letters furnish abundant proof.

The "American Letters" properly begin with No. XIII (Teneriffe, June 20th, 1799), and thereafter the correspondence bristles with details of Humboldt's activity in research. His allusions to observations and studies in the "field" show that he devoted himself to every branch of science, not only with an enthusiasm that knew no bounds, but with a knowledge and practical sense astonishing in a man of only thirty years of age. It becomes impossible henceforth to follow details—we can but call attention to some points that are more particularly emphasized by the documents.

Perhaps the most insignificant, but still biographically interesting, of these is the gradual improvement of Humboldt in the use of the French idiom. His earlier letters contain orthographic mistakes, little by little these disappear, and a phraseology prevails that approaches more and more nearly to good French, conceived in classical German. It is so difficult, for any one not born to the language, to write it with French intuition. That improvement, however, is certainly due to the long and intimate association with Bonpland. The latter was not proficient in the German language, hence the two companions, for years, had to communicate in French. Both acquired Spanish thoroughly, and Humboldt even asserted that the latter idiom was to him as familiar as his own native tongue, but French remained the medium of understanding for both, and Humboldt profited by it. There cannot be any doubt either that Bonpland exercised a considerable influence on the ideas of Humboldt in regard to the life of vegetable organisms. The former was a strict, severely technical botanist. Humboldt himself was an able adept of botany, he had shown it at an early day in his dissertation on the fossil plants of the carboniferous age. But his admirable essays on the physiognomies of vegetation, on the geographical distribution of plants (*Aspects of Nature*, and notes) prove that his knowledge of structural details of plants greatly improved through Bonpland's patient labours. Only the latter remained strictly technical, whereas Humboldt never lost sight of the vaster perspective, considering each field but as part of a grand *ensemble*, searching for the connection of the life of plants with the life of the animal kingdom, of man and his destinies, of the ocean as well as of the highest mountains. In one of his letters he states (Baron de Forell, XXIV from Caracas, 1800) "man is born to be grateful." That beautiful maxim he followed throughout all his life, and especially towards his companion Bonpland, whose merits he always upheld. In Humboldt's character affection was very salient.

What we have alluded to in the beginning as having been Humboldt's ideal, the establishment of the "Natural Philosophy of the Globe" upon a secure basis, grows during our perusal of these letters, from a timid ideal to a logical system of study. The more he ascertains, the more he connects. And not only terrestrial phenomena, he is carried by degrees to a penetration of the sidereal world, the picture of "Kosmos" as a whole.

While scientific notes (some of which assume the proportion of dissertations) are found in nearly every one of the sixty-three letters, personal experience, adventures, occupy but a limited space; and then only when they serve to enliven descriptions, the beauty of which foreshadows the "Aspects of Nature." That Humboldt made the entire American journey at his personal expense is well known. When he returned he found his capital decreased to 58,500 thalers, representing an annual income of a little more than 8,550 francs. He expected to have spent all his income and 8,000 thalers of the principal on the American journey, supporting himself and Bonpland out of his own means.

The last eight letters are from Berlin. They begin at the end of 1805, and go to February, 1807. That period must have been particularly trying to one who, like Humboldt, was deeply attached to France, while, on the other hand, he was German, and specifically Prussian, by origin, birth, and duty. Still, not a word of allusion is found in his last letters to the military and political disasters that befell his native country. He certainly was not insensible to them, but he took no active part. Science was his realm. He was then hardly thirty-eight years of age, and in full vigour, which he devoted exclusively to the pursuit of the task he had selected for his life. In later years he became, through his intimate relation with the King of Prussia, connected in a limited way with politics. Of that period and side of his life, the intimate letters to Varnhagen von Ense, published in 1860 by Ludmilla Assing, contain much more information. The "Lettres Américaines" relates exclusively to his scientific career, while throwing interesting side-lights upon his character, his faithfulness to friendship, and his disinterested eagerness to assist any one who proved himself honest in research.

Noteworthy among the pieces of the Appendixes is the one entitled "My Confessions," addressed to Marc Auguste Pictet in the year 1805. It is a brief picture of the writer's early life and scientific career, and contains nothing to recall the common interpretation of the word. These "Confessions" are merely a simple and modest statement of how Humboldt came to be what he was, with tributes of gratitude: first, to his parents, for the very "careful" education they gave him, and afterwards to everyone who befriended him in his early days. The *ego*, not seldom disagreeably prominent in confessions, is here as genuinely noble as in Marcus Aurelius.

A. F. B.

De l'Amazone au Pacifique par la Pampa et les Andes. Par Gaston Donnet. Vingt-huit Photographies. 310 pp. Paris, Librairie Ch. Delagrave. 1906.

Although quite interesting, this little book need be but cursorily reviewed. The illustrations are poor, and the text of small comparative importance. In matters of history it bristles with errors. Some appreciations are true, however. For instance, that of the government of Chile, portraying it as an oligarchy, which is the fact, and to which Chile owes its strong political and military standing in South America. Mr. Donnet's almost contemptuous treatment of the late Emperor of Brazil and his fall is very much out of place. The Empire, not the Republic, made Brazil what it is, and Pedro II. was not by any means out of date or superannuated, as the author affects to represent him. The Argentine gets off with the very true remark, that it is peopled with all nationalities imaginable, even by Argentines.

Mr. Donnet's descriptions are generally very readable. He has well seen and felt the nature of the countries through which he has travelled. Some of his descriptions of animal life may suffer from exuberance.

A. F. B.

The World of To-Day. A Survey of the Lands and Peoples of the Globe as seen in Travel and Commerce. By A. R. Hope Moncrieff. Vol. V. viii and 266 pp. Maps and Illustrations. The Gresham Publishing Co., London. 1906.

This fifth volume of the popular work by A. R. Hope Moncrieff deals with South and Central America, Mexico and the Antilles. By "popular" only the style is meant, for there is barely a page of the text that does not bristle with the most unpardonable errors and misstatements. Of course, its spirit is thoroughly British. The illustrations look well, though a number of them are out of date. The text proper is generally unworthy of serious attention.

Even the "Geographical and Commercial Survey" at the end is not free from clumsy mistakes, and in figures. And yet it is the only part of the book that may serve as an excuse for its publication. The diagrams are handy for the cursory reader. and as most of the data are taken from modern statistics, where such are accessible without much painstaking, there is at least an "air" of reliability about them. Altitudes are mostly incorrect, even where positive data exist, but the author only relies upon English information in most cases. Many of his hypsometric data in the Appendix clash glaringly with others given in the text, showing the careless and slovenly way in which the author has performed his task.

A. F. B.

History of the Ohio Canals.—The history of the development of our transportation would lack an important chapter should it fail to give due prominence to the Ohio canals. They were constructed by the people of that State at a tremendous cost of money, energy and sacrifice, not to reap a direct money return on the investment, but because the canals were needed to provide transportation, stimulate industry, and develop the young State. Two graduates of the Ohio State University, Messrs. C. P. McClelland and C. C. Huntington, have written a complete account of the canals, their origin and construction. the abandonment of some of them, their financial record, and a full statement of the economic value of the canal system to the people of Ohio. The monograph has been approved by the Ohio State Archæological and Historical Society, Columbus, which has published the book. The book contains 181 pp., with a map of the Ohio canals, and is sold at $1.10; in paper, 85 cents.

Mittelmeerbilder. Gesammelte Abhandlungen zur Kunde der Mittelmeerländer. Von Dr. Theobald Fischer. vi and 480 pp. B. G. Teubner, Leipzig, 1906. (Price, M. 6.)

Many geographers are aware that the special field of study which Dr. Fischer has occupied for the past third of a century has been the Mediterranean lands. He has made at least a score of journeys, long or short, in the countries bordering the Mediterranean from the Bosporus to the southwest coast of Morocco. This book is a collection of some of the contributions he has made to the knowledge of these lands. The articles appeared in scientific or popular magazines and newspapers and nearly all the descriptions are based upon personal observation. Five of the papers were written within the past five years; the others at intervals between 1870 and 1900. The older papers have been brought up to date in all respects in which they might, in their original form, give erroneous impressions. Five of the papers deal with Constantinople and other parts of the Turkish domain. A fine, condensed description of Palestine, describing, as only a trained geographer may do, the physical features, climate, plant life, population, industrial conditions, and government of the land, fills 80 pages. Italy receives similar treatment in 82 pages, 19 pages are given to the Iberian peninsula, and a series of eight articles on the Atlas lands covers 202 pages or nearly half the book. While the purpose of these writings was to reach a far wider circle than the ranks of geographers may supply, they are the first rate product of a man of science who expresses the hope in his preface that most of them contain much of interest even for the specialist. The book is to be especially commended to those who desire to read a clear and authoritative summing up of the leading characteristics of these various countries.

Philippine Life in Town and Country. By James A. Le Roy. x and 311 pp. 16 Illustrations, Map and Index. G. P. Putnam's Sons, New York, 1906.

One of the series of "Our Asiatic Neighbours." The author avoids politics and endeavours to set forth the Filipinos as they are. It is impossible, however, to present the national and tribal aspects of the natives without, at least, grazing the edge of political questions. Mr. Le Roy by the word "Filipinos" means the Christianised inhabitants, who constitute nine-tenths of the total population. To the Filipinos, thus defined, most of the book is given, to the exclusion of the pagan and more or less savage tribes and of the Mohammedan Malays (Moros). In the second chapter, however, he shows the probably close connection of the Moros and pagans with the Christian Filipinos in their racial origin and insists upon the underlying racial unity of the whole people, excepting none but the Negritos. It might be inferred from the title "Philippine Life" that the book is purely descriptive, but, fortunately, the writer had no merely superficial purpose in view, and the work is not to be classed with the descriptive sketches about the Filipinos of which we have had a surfeit in the past seven years. It deals with the significant facts at the basis of Philippine society and the general movements which make up that society as it now exists. Among the topics are religion, local self-government, education, tribal and geographical influences towards disunion, trade and internal development, the city dwellers and the rural Filipino communities. The illustrations are excellent. Mr. Le Roy's connection for two years with the U. S. Philippine Commission gave him unusual opportunities for study and observation, and his book is suggestive and informing.

No Man's Land. A History of Spitsbergen from its Discovery in 1596 to the Beginning of the Scientific Exploration of the Country. By Sir Martin Conway. x and 377 pp. 11 Illustrations, 13 Maps, Index and Appendices. Cambridge University Press, Cambridge, 1906. (Price, 10s. 6d.)

The author appeals to reviewers and readers henceforth to spell the name of this archipelago Spitsbergen instead of Spitzbergen. The name is Dutch, not German, and the spelling with a "z" is a comparatively modern blunder. The fact is, however, that most nations have, for over two centuries, spelled the name with "z" in spite of its Dutch etymology, and there is little probability that an error so long persisted in will be rectified by general consent at this late day.

Sir Martin Conway's book tells the story of events that happened on the shores of Spitzbergen from the discovery of the archipelago by Barents in 1596 down to the era of modern scientific exploration. These Arctic lands, inhospitable as they are, made chapters of history that are uncommonly animated. This region, for generations, was the centre of a large and profitable whale fishery, and bloodshed was often the result of the disputes between rival nations over the fishing grounds. Sir Martin made thorough researches in rare books of old travel to get the material for the narrative, and he has written certainly the most complete account in English of the great industry that added scores of millions of dollars to the wealth of a few European countries. His two journeys of exploration in Spitzbergen gave him personal acquaintance with the region, which has been of great service to him in the interpretation of many of the statements of seventeenth century navigators. Now that Spitzbergen is visited every summer by tourists, the islands are becoming known in wider circles, and this fact gives a special timeliness to this admirable book. Geographers will admire the excellent map of Spitzbergen (without a scale, however,) which Sir Martin compiled for the book. Its value is also enhanced by the author's appendices giving a list of the principal voyages to Spitzbergen, a bibliography of its history and geography, and a critical review of its cartography.

Stanford's Geological Atlas of Great Britain. (Based on Reynolds's Geological Atlas.) With Plates of Characteristic Fossils. Preceded by a Description of the Geological Structure of Great Britain and its Counties, by Horace B. Woodward. x and 139 pp. 50 Plates of Maps and Illustrations, and Index. Edward Stanford, London, 1904. (Price, 12s. 6d.)

Those Americans who have an interest in the geology of Great Britain should know of this book, which is well calculated to enhance their pleasure and information as they travel through the country. It is based upon Reynolds's Geological Atlas, which, for years, was helpful to many who travelled on business or pleasure; but the latest of its editions was published in 1889, and it is therefore out of date. The admirable plan of the older work was adopted for the new book, but the text has been entirely rewritten and enlarged. The descriptions of the geological formations are much fuller than in the earlier book and some new features have been added, such as descriptions of the rock exposures observable along the main lines of railway. Any one with only an amateur's interest in geology will find the book a pleasurable companion.

Mr. Woodward's letterpress opens with a general survey of the geological structure of Great Britain and a list of mineral products and their distribution. This is followed by a succinct account of the geology of each of the counties. Thirty-two pages are devoted to the geological features along the railroads, and the instructive descriptions call the traveller's attention to the way in which the character of the scenery and even of the buildings has been influenced by the changeful geological structure. More than half of the volume is occupied by the county geological maps in colours and sixteen plates of fossils. Geological sections and other illustrations are scattered through the work, and the index makes all information easily accessible.

Things Indian. Being Discursive Notes on Various Subjects Connected with India. By William Crooke. xi and 546 pp. and Index. Imported by Charles Scribner's Sons, New York, 1906. (Price, $3.)

The topics are arranged in alphabetical order. It is the aim of the author to discuss many of the quaint and curious matters connected with India that are not specially considered in the ordinary books of reference, such as amusements, bamboo, carpets, children, dacoity, etiquette, famine, human sacrifice, jewelry, marriage, suttee, and others. Over 160 topics are treated and the copious index makes all the information readily accessible.

In a page and a half given to "Barasaul Guns" the writer says the mysterious sounds heard occasionally in the neighbourhood of Bárásál in the Ganges delta, resemble the dull, muffled boom of distant cannon or are like a cannonade between two widely-separated forces. Many explanations of the phenomenon have been suggested, but the question has not yet been definitely decided. On the whole, the wave theory propounded by Mr. Pellew seems best to account for the facts. Mr. Pellew said before the Asiatic Society of Bengal in 1870:

> The waves of the length of a mile or so, advancing obliquely from the S.S.W., would break successively on the coast from W. to E. To a person close by the sound of each wave would be somewhat continuous; but to a person forty or fifty miles off, if the waves broke simultaneously, the sound would be a boom like that of a gun, because both extremities of the wave would be at the same distance from the hearer at the centre.

L'Afrique au Début du XXe Siècle. Par M. Fallex. vi and 340 pp. 118 Maps and Illustrations. Librairie Ch. Delagrave, Paris, 1906. (Price, 3 fr.)

A superior text-book for the higher geographical classes. Like many French books, it partakes of the nature both of the text-book and the geographical reader. Its geographical quality, accuracy, numerous black maps, and mechanical production, make it desirable not only for the class room and the general reader but also for the tourist. A traveller who desires to have the geographical essence of the region in Africa he may visit in book form, may find it in this little volume as clearly and as well set forth as in any book on Africa. Each chapter is preceded by a summary giving the essentials of the several topics discussed. The work is marred by comparatively few errors.

Die Eisenbahnen des Brasilianischen Staates São Paulo. Von Alberto Kuhlmann. 39 pp. Illustrations and Map. Published by the Author, São Paulo, 1904.

The late Mr. Kuhlmann had special facilities and equipment for giving the history of the development of the railroad system in São Paulo. The pamphlet contains a relief map of the zone between Santos and São Paulo, a considerable number of excellent photographs that help the text, gives a clear insight into the condition of railroad transportation in that region and outlines the future of the industry, as the author believed it would develop in São Paulo. We quote from the work:

> No country in the world, excepting the United States, has shown such progress economically, and especially in the sphere of railroads as the State of Sao Paulo in Brazil. The fact that all these lines, with the exception of two or three, are working profitably, is of the greatest consequence in the development of the railway system, showing, as it does, that it was not purely a speculative enterprise. The immense capital, foreign and domestic, which is sunk in these lines, as well as the almost incalculable material necessary for the construction and working of them, are facts of general interest.

Geology. By Thomas C. Chamberlin and Rollin D. Salisbury. Vols. II and III. New York, Henry Holt and Company, 1906.

The scientific public is to be congratulated upon the completion of this masterly treatise upon Geology, which gives in succinct form the principal features of the most advanced thought and the latest investigations in one of the most rapidly developing sciences of the present day. The first volume of this monumental work dealing with geological processes and their results appeared two years ago, and was briefly reviewed in the BULLETIN for May, 1904. The second and third volumes treat of the "History of the Earth," the division between the two volumes being at the end of the Permian period, an epoch of the highest importance in the geological history of the earth. When the first volume was issued the authors announced that the work was to be completed in two volumes; the growth of the part devoted to earth history from one volume to two is an indication of the vast amount of material which has been utilized in the treatise.

In the preface the authors state that their effort throughout has been "to keep the discussion as free from technicalities as practicable and to render the matter readable." Technicalities can hardly be avoided in the elaboration of such abstruse and fundamental ideas as are treated in these volumes, but "readable" the whole book certainly is. Clear English, direct statement, distinct separation of theory from fact, abundant illustrations, and many illuminating diagrams and maps combine to make the rather ponderous tomes a constant delight and inspiration to the professional geologist and a necessary handbook to the advanced student. The new geology does not pretend, however, to be a manual; it is rather a discussion of basal principles and of geological formations in their broad characteristics and relations. Details of the geology of particular regions are omitted, except where needed for the comprehension of generalized statements.

The first pages of Volume II plunge the reader at once into the intricacies of expositions of the main theories that have been advanced to account for the origin of the earth and the solar system. After a brief but compendious statement of the still generally accepted so-called "Nebular Hypothesis" of Laplace, together with proposed modifications bringing it more into accord with modern thought and investigation, and a more extended discussion of the Meteoritic Hypothesis as modified and elaborated by Lockyer and G. H. Darwin, our authors pass on to a succinct elucidation of the Planetesimal Hypothesis, which has gradually been elaborated by Chamberlin during the past ten years or more. Regarding this new theory we can do no better than to quote the summary thereof given by its sponsor (Vol. II, p. 81):

> The planetesimal hypothesis thus assumes that the solar system was derived from a nebula of the most common type, the spiral, and that the matter of this parent nebula was in a finely divided solid or liquid state before aggregation, in harmony with the continuous spectra of spiral nebulæ. It regards the knots of the nebula as the nuclei of the future planets, and the nebulous haze as matter to be added to these nuclei to form the planets. It assumes that both the knots and the particles of the nebulous haze moved about the central mass in elliptical orbits of considerable, but not excessive, eccentricity. It postulates a simple mode of origin of the nebula connected with the not improbable event of a close approach of the ancestral sun to another large body, but the main hypothesis is not dependent on this postulate.
>
> It assigns the gathering-in of the planetesimals to the crossing of the elliptical orbits in the course of their inevitable shiftings. Out of this process and its antecedents, it develops consistent views of the requisite distribution of mass and momentum, of the spacing out of the planets, of their directions of rotation, of their variations of mass, of their varying densities, and of their peculiarities.
>
> It deduces a relatively slow growth of the earth, with a rising internal temperature developed in the central parts and creeping outward. With such a mode of growth, the stages of the earth's early history necessarily depart widely from those postulated by the Laplacian and meteoritic hypotheses.

Having promulgated the new theory at length, Chamberlin and Salisbury do not seek to explain the history of the earth by it to the exclusion of the consideration of the older theories. On the contrary, in each instance the modified Laplacian hypothesis is cited fairly and the objections to it stated clearly before the accretion (planetesimal) hypothesis is brought forward. The weak places in the new theory, too, where recognized, are stated. Whether the reader accepts the accretion theory or not, he must appreciate the masterly manner in which the authors have stated the difficulties which have been encountered in the application of the gaseo-molten (modified Laplacian) hypothesis. The divergence of the new theory from the old is shown most strikingly in the discussion of the hypothetical stages leading up to the known geological eras and of the partly known Archæan era. The importance of the bearing of the accretion theory is shown further in the discussion of vulcanism (mostly in Volume I), deformation, atmosphere, and climate (including glaciation).

The work lays more stress upon the physical than the palæontological side of the science, *i. e.,* it is a treatise upon geology, not palæontology, and a noteworthy feature is the absence of the long lists of the fossils characterizing the formations which are to be found in nearly all general geologies. Much attention, however, is paid to the question of the rise, distribution, and disappearance of one fauna and flora after another and to the consideration of the causes leading to these changes in the life upon the earth. North America is taken as representative of the whole earth, and comparatively little is said about the geology of the other continents. These two volumes, therefore, give "a connected and interpretative sketch" of the earth, as illustrated particularly by this continent. Throughout the work stress is laid, as far as knowledge warrants, upon the surface features of the progressive stages of the land and upon the permanence of the continents. In this connection mention should be made of the series of maps showing the continent of North America in the successive periods, because they represent not only the present surface distribution of the rocks of the period, but also the probable concealed extension of the beds beneath later formations, the degree of probability being indicated by shading. A sufficient number of excellent figures illustrates the characteristic fossils (Leitfossilien) of the formations, without going far into the details of species. An important feature of the work is the general geological map of the United States and part of Canada compiled by Mr. Bailey Willis with the aid of geologists of the U. S. Geological Survey. Such a compilation had not been made before in twenty years, during which period enormous strides had of course been made in the knowledge of the geology of many parts of the country. The map bears the date of 1903.

In the arrangement of the subdivisions of the geological scale some changes have been introduced which will at once attract the attention of the reader who is familiar with the older textbooks and manuals. The term Proterozoic, originally proposed by R. D. Irving, is revived and given equal rank with Paleozoic in the time scale. It has the same meaning as the Algonkian of the U. S. Geological Survey, and comprises the Huronian, Animikean, and Keweenawan, covering the interval between the Archeozoic (Archean) and the Paleozoic. Williams's names Mississippian and Pennsylvanian are adopted for the Subcarboniferous and Coal Measures respectively, while Hill's name Comanche is used for the Lower Cretaceous of authors, and the term Cretaceous is restricted to the Later, or Upper, Cretaceous of previous treatises. Contrary to the law of priority and the usage of Dana, Geikie, and other authorities (except de Lapparent), Lapworth's name Ordovician is used for the Lower Silurian of Murchison. This use of the term Ordovician is spreading in the United States, but it works great injustice to the labours of Sir R. Murchison, and is to be deprecated.

A noteworthy and valuable feature of the stratigraphical portion of the work is the publication in tabulated form of the geological sections in several typical areas of the country. The sections which are given in connection with several of the great periods are supplemented in the Appendix by twenty-two sections for the entire geological scale as represented in as many parts of the United States from Massachusetts to Florida. These are conveniently presented for ready reference.

As was to have been expected from the character of most of the field work of both authors, much stress has been laid upon the subject of glaciation in all its bearings. Boulder-bearing beds containing striated stones have been found in Norway and in China, which indicate the occurrence of extensive glaciation during the opening stages of the Paleozoic previous to the undoubted Cambrian. The chief ancient glacial period, however, was at the close of the Permian in England, South Africa, India, and Australia, and new illustrations from South Africa are published. The fact is brought out that this Permian or Permo-Carboniferous glacial period affected a much larger area than was covered by ice during the Pleistocene glacial period, and its distribution was equatorial rather than circumpolar, like the Pleistocene glaciation. This localization of the glaciers is considered to be the most puzzling feature of the whole problem, and the explanation of it is thought probably to lie in the great late Paleozoic development of the land connection from South America *via* Antarctica to New Zealand and thence to Australia and India, which concentrated warm waters in the Pacific and cold waters in the Indian Ocean and produced profound climatic changes. At the same time a broad tongue of the Arctic sea is supposed to have occupied eastern Russia and western Turkestan, co-operating with the peculiar conditions in the southern hemisphere to produce refrigeration in low latitudes.

Limitations of space forbid our reviewing in detail all the features of this great work, and we pass over almost in silence the discussion of Mesozoic and Cenozoic time, with its abundant reference to the labours of the vertebrate palæontologists, which have added so extensively to our conceptions of physiographic and climatic conditions in western America as well as to our knowledge of the animal forms peopling the continental land surfaces. The probability, too, is admitted that many beds formerly assigned to great Tertiary lakes are of æolian or sub-aërial origin and that lakes were incidents rather than characteristics of Tertiary time.

Turning to the Pleistocene, or Glacial, period, many of the younger readers of this book will be surprised at the marshalling of facts to prove the glacial origin of the great deposits of clay, sand, and boulders which we know as "Drift" and which cover half the plains of North America and vast areas in Eurasia, so generally accepted at the present day is the fact of extensive glaciation in the northern hemisphere in recent geological time. Six invasions of the great ice sheet are recognized; but they were of unequal extent and duration, and were separated by unequal intervals of time, and consequent recession. The stages are, beginning with the earliest: (1) Sub-Aftonian, or Jerseyan, (2) Kansan, (3) Illinoisan, (4) Iowan, (5) Early Wisconsin, (6) Late Wisconsin.

The æolian origin of the Lœss is held to be most probable, the material being considered to have come from river bars and flats exposed in times of low water and from the rock-flour brought down by the continental ice sheets. The evidence for the appearance of man in North America before the final retreat of the continental ice sheets is thought to be sufficient.

The theories which have been advanced to account for the Glacial period are (1) the hypsometric hypotheses, or those appearing to elevation of the land, (2) the astronomic hypotheses, such as variations in the eccentricity of the earth's orbit and the wandering of the earth's axis of rotation, (3) the atmospheric hypotheses, or those which appeal to changes in the constitution or movements of the air. Reasons are given for discarding the first two groups of hypotheses, and then the arguments in favour of the third are brought forward at some length.

Our authors consider that the general conditions favourable to glaciation were supplied by the extensive deformation of the land which took place at the close of the Pliocene period, resulting in great changes in the circulation of oceanic currents, in the acceleration of the vertical circulation of the atmosphere, and in the reduction of the average temperature of the atmosphere by a depletion of moisture and carbon dioxide. The localization of the glaciation is assigned to the two great areas of permanent atmospheric depression that have their present centres near Greenland and the Aleutian Islands respectively, and which may be presumed to have been extended and intensified during the glacial stages. The explanation of the periodicity of glaciation is based upon the conception that

> under conditions favorable for glaciation certain of the agencies involved became dominant and tended to intensify and accelerate glaciation for a time, until they either pushed the effects to an extreme from which a reaction was inevitable, or they exhausted themselves temporarily, while other agencies of opposite phase, which had been subordinate until then, became dominant and forced a reaction.

Each volume is supplied with a copious index besides a full table of contents, the index to Volume III being general for the whole work. E. O. H.

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LABRADOR, FROM LAKE MELVILLE TO UNGAVA BAY.

BY

MRS. LEONIDAS HUBBARD, JR.

In the northeastern portion of the Dominion of Canada is the great Labrador Peninsula, which, though first to be discovered, is of all the regions of North America the last and least explored. North of the fifty-fourth parallel it is nine hundred miles in extent from Hudson Bay on the west to the Atlantic Ocean on the east, and between its southern boundary, the Gulf of St. Lawrence, and its extreme northern point at Hudson Straits lie eight hundred miles of almost unbroken wilderness. The peninsula is estimated to contain 511,000 square miles, its interior being a vast elevated, rocky, irregular plateau, in places standing well out to the coast and cut by valleys down which great rivers carry to the sea the waters of its myriads of lakes and streams.

Knowledge of the interior of the peninsula was until the sixties confined to that obtained by the agents of the various Hudson's Bay Company's posts established at long intervals on the coast and in the interior; but, in accordance with the policy of the Company, their findings were not recorded. One notable exception to this rule was that of John McLean, to whom falls the honour of being the discoverer of the Grand Falls of the Hamilton River. In 1838, 1841, and 1842 he crossed and recrossed the country lying between Lake Melville and Ungava Bay; but the accounts of these journeys which appear in his "Twenty Five Years in the Hudson Bay Territory" are very incomplete, and he left no maps.

In 1862, Henry Yule Hind made his survey of the Moise River. In 1887, Dr. R. F. Holmes, an English traveller, made an attempt to reach the Grand Falls of the Hamilton, two hundred and fifty miles above the mouth of the river, but was obliged to return without accomplishing his purpose, his crew proving inefficient and his outfit inadequate. In 1892 two expeditions from the United States reached the Grand Falls—one from Bowdoin College under Messrs. Carey and Cole, and the other under Mr. Henry G. Bryant, recently President of the Philadelphia Geographical Society.

But the great Labrador explorer is Mr. A. P. Low, Director of the Geological Survey of Canada. More than that of all others, his work has tended to dispel the darkness of mystery so long shadowing the interior of the great peninsula. Yet Mr. Low's work, which extended over a period of ten years, and which is set forth in the reports of the Geological Survey of Canada, had left the northeastern portion, lying between Lake Melville and Ungava Bay, still virgin field for the explorer, where remained two large rivers to be traversed and mapped.

On the 15th of July, 1903, Leonidas Hubbard, Jr., my husband, with two companions, set out from Northwest River Post, near the head of Lake Melville, for a canoe trip into the interior, which he hoped would not only afford him an interesting wilderness experience but also an opportunity to explore and map one, and perhaps both, of these rivers, the Northwest River draining Lake Michikamau to Lake Melville, and the George River draining the northern slope of the plateau to Ungava Bay.

Misled by information obtained at the post, which corresponded with the indications of the map he carried, that of the Geological Survey of Canada, Mr. Hubbard took the Susan River, which enters Grand Lake at its upper extremity, instead of the larger river draining Lake Michikamau and entering Grand Lake at the head of a bay five miles from its western end. The Susan River led them, not by an open waterway to Lake Michikamau, but up to the edge of the plateau, where they became lost in the maze of its lakes. When within sight of the great lake the party was forced to begin a retreat which Mr. Hubbard did not survive to complete, and the object of his expedition was not achieved.

Nevertheless, in utter physical weakness, utter loneliness, in the face of defeat and death, he yet wrote that final record of his life, so triumphantly characteristic, which turned his defeat to a victory immeasurably higher and more beautiful than the success of his exploring venture could ever have been accounted, and thus was compassed the higher purpose of his life.

That his lesser purpose might not remain unaccomplished, I myself in 1905 undertook the conduct of the second Hubbard Ex-

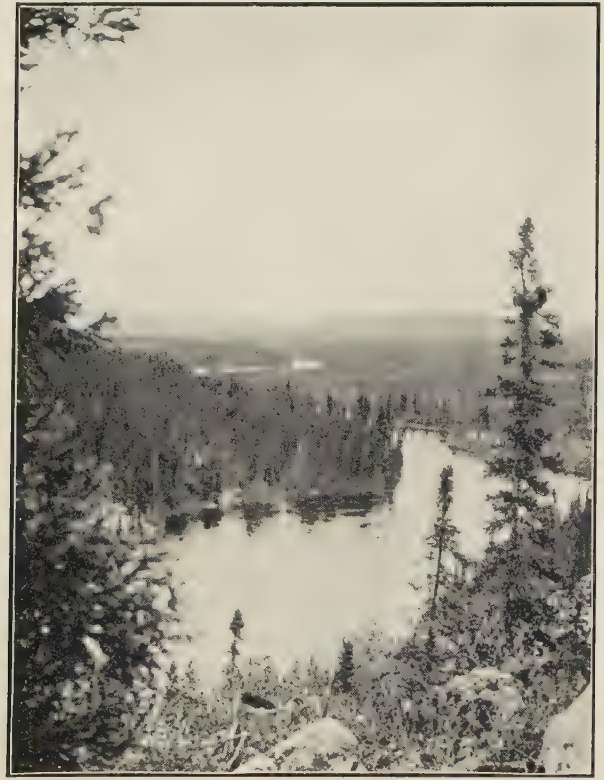

FIG. 1.—EMERGING FROM THE HILLS TO CROSS THE SAND PLAIN, UPPER NASCAUPEE.

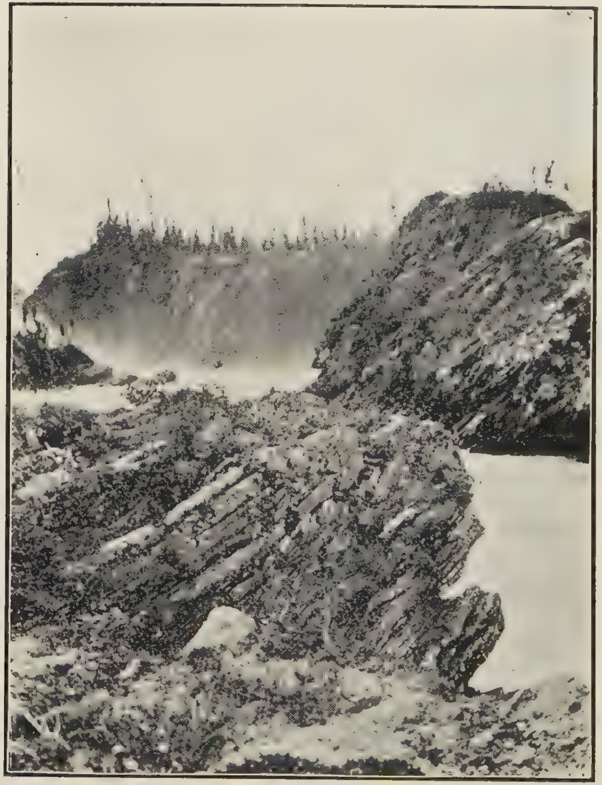

FIG. 2.—GORGE BELOW MAID MARION FALLS.

pedition, and, with the advantage of the information and experience obtained by the first, a larger crew and a three weeks' earlier start, successfully completed the work undertaken two years before. The map which this article is intended to accompany sets forth the work I was able to accomplish. It does not claim to be other than purely pioneer work. I had with me a surveyor's compass and a sextant and artificial horizon. I took no observations for longitude, but obtained a few for latitude, which served as guiding points in making my map. Owing to the fact that I depended on water instead of taking mercury with me for my artificial horizon, a number of observations were lost because of the ease with which the surface of the water was disturbed and the gathering of moisture on the glass. The controlling points of the journey were already astronomically fixed.* The shores of the lakes were not explored, but outlined as they appeared from the canoe or from the top of a hill.

The map of the route of the first Hubbard Expedition is from one drawn for me by George Elson, with the few observations for latitude recorded by Mr. Hubbard in his diary as guiding points. Mr. Hubbard's note-book, containing his maps and other records, I have not had access to.

My expedition left Northwest River Post 3.30 P.M., June 27th. I had two canoes and four guides, chief among whom was George Elson, who had loyally served Mr. Hubbard in 1903, and who had, with a rare skill and a rarer devotion, recovered Mr. Hubbard's body, his records, and his photographic material from the interior, in the depth of the following winter. My supply of provisions totalled 750 lb., the complete outfit weighing 1,000 lb. July 17th found us at the head of Seal Lake. August 2nd we made our first camp on Lake Michikamau. August 10th we arrived at the Height of Land, and in seventeen days made the run down the George River to the post at Ungava, arriving there at 11.20 A.M, August 27th.

The Nascaupee River may be said to have its origin in Lat. 54° 50′ and W. Long. 64° 30′, at the edge of the Height of Land, its course from this point to the ocean describing a somewhat awkward-looking letter W. The distance in a straight line to its discharge into Lake Melville is two hundred miles, but following the windings of its course is about three hundred miles. From the Height of Land a series of lake expansions stretches nearly one hundred miles east of south, the last and largest being Lake Michikamau, of all the lakes of the interior second only to Mistassini in size. It is sixty miles long and twenty-five miles in width at its widest. The Nascaupee River issues from the lake to the east a few miles north of Lat. 54°. The outlet is partly concealed by a large island to the south, and the river flows from the lake round a low wooded point, breaking into rapids as it spreads about the islands in the upper end of Lake Agnes. Its course is now northeast to Seal Lake, the first fifty miles being through the great plain of the lakes, where MacKenzie and Fremont are its largest expansions.

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* Northwest River Post, Lake Michikamau and its outlet, and the mouth of the George River.

Here a thousand lakes spread over the country, separated from Lake Michikamau by a low ridge extending northward along its eastern shore. Across the plain from east to west stretches a succession of low wooded ridges, seeming to become higher and more barren in the north. The wood growth is of small spruce and larch, unrelieved by the touch of white birch and poplar found in plenty on the lower levels, and the ridges extend eastward to the long portage and beyond, and are separated from the great irregular hills which occupy the country west of Seal Lake by a broad sand plain. To the south of the lakes the country is more rugged and barren, big rocky hills standing out towards Lake Michikamau.

At the foot of Lake Marie the river descends from the plain at Isabella Falls, a system of falls and rapids and chutes extending for more than a mile, where the water rushes over ledges, round rocky islands and through miniature cañons, an abrupt right angle bend midway of the descent adding to the wildness and picturesque beauty of the scene. The rock, which is Laurentian, is rich red brown, almost purple in colour, and its perpendicular surfaces are patched with a close grey-green moss and a variety the colour of vermilion. Islands and shores are wooded, and the dark spruces stand out in strong relief against the white of the reindeer moss. From this point eastward to beyond our long portage, which is as far as the wooded country extends, there is a perceptible difference in the size of the trees, those in the sheltered river valley attaining a larger growth than those on the plain above.

For the next seven miles the river drops rapidly. Two wild and impassable rapids occur before reaching Gertrude Falls, where the river takes a direct drop of about sixty feet, flowing on in almost continuous rapids to the next drop at Maid Marion Falls. Here it descends fifty feet into a narrow channel cut out in the gneiss and schists of the Laurentian, emerging from the hills ten miles below to a terraced sand plain four miles wide. Beyond this it passes through the sea of hills west of Seal Lake. The main drop in this part of its course takes place in a fall of a few feet a short

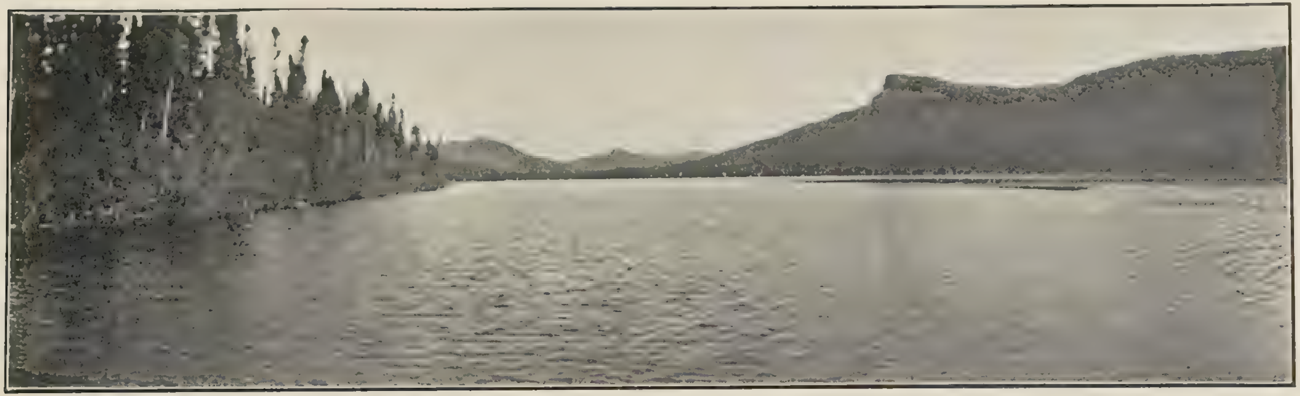
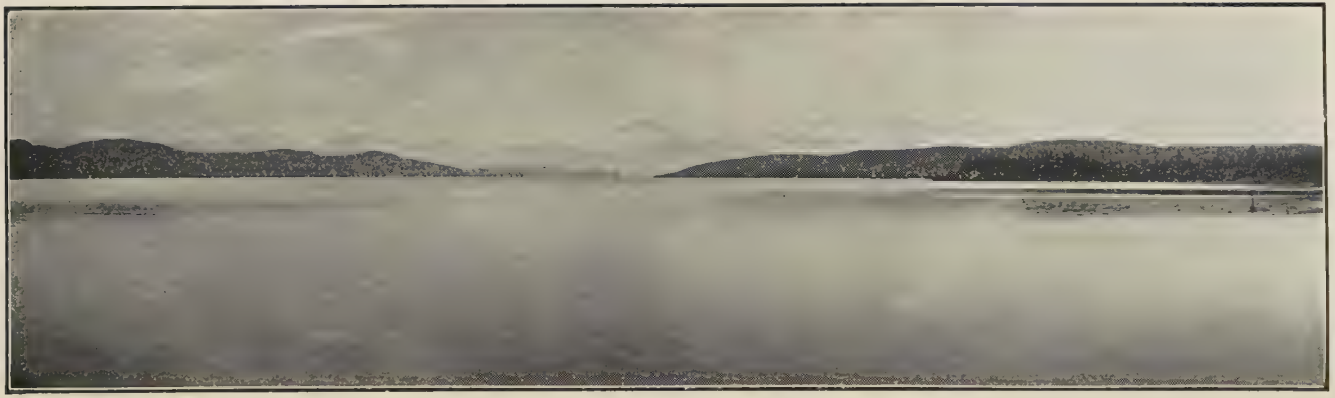


FIG. 3.—WHERE THE NASCAUPEE LEAVES SEAL LAKE.



distance below the plain, and at Cascade and Seal Rapids, though there are a number of smaller rapids. There is little green wood along this part of the river, the country here and around the northern part of Seal Lake having been burned over long ago. It is now grown up with poplar and white birch, from the midst of which the rocky hilltops rise bare and stern. A few small lake expansions occur, Wachesknipi being the largest. Here the country flattens out again to low sand ridges, and the river, bending a little to the south, enters Seal Lake.

From the northern extremity of the lake an arm, which, according to the trappers, is thirty miles long, extends away to the west. As far as we could see, the hills along its south shore drop abruptly to the river, like the Palisades of the Hudson. The course of the river is to the south, the lake contracting seven miles down to about three hundred yards in width, where perpendicular cliffs rise from the water edge and the current is very swift. The lake is surrounded by hills, the wildest and most rugged region being that about the outlet. It lies close to the edge of the plateau, and, from the point where the river leaves it, the water breaks into tossing rapids. From here to the northern extremity of Bald Mountain the river is still unexplored. According to the trappers, it rushes down a continuous rocky slope, the hills in places rising perpendicular from its edge.

Below the bend at Bald Mountain the direction of the river is southeast to Grand Lake. Its course lies mainly through sand hills and terraces, its banks varying from a few feet to sixty and eighty and one hundred feet in height. The valley is mostly well wooded with spruce and balsam as far as Mabelle Island, and here the spruce reaches splendid size. The trees are very tall and straight, and one I measured was nine feet in circumference. Below the island the country was swept by fire twenty-five years ago, and the new growth is still quite small. Among the hills Bald Mountain and Mts. Elizabeth and Sawyer are the most prominent features, being apparently more than a thousand feet in height. From Bald Mountain the rapids are continuous to Point Lucie, below Mt. Sawyer, the heaviest being North Pole and Three Mile Rapids. The remaining seventeen miles to Grand Lake is smooth water, though the current continues swift, and the river enters the lake around a number of small wooded islands, which entirely obscure it from the lake.

Grand Lake is forty miles long and four miles wide, and is very deep. It lies south of east among its hills, the highest and most striking of these being Berry Head on the north shore, and Porcupine Hill, Cape Blanc, and Cape Corbeau on the south. From the eastern extremity of the lake a three-mile stretch of rapid river carries its waters to Lake Melville, where, together with those of the Grand or Hamilton, they pass northeast, entering the Atlantic north of the 54th parallel.

Throughout its length the Nascaupee receives tributaries of considerable size, on the upper river the principal contribution coming in from the north. Its waters are clear and cold, though some of the streams which enter it below Seal Lake are red brown water. On June 29th I found its shores at the foot of Three Mile Rapid lined with ice banks eight and ten feet thick, though above them violets were in bloom. On August 3rd we saw large masses of ice, like miniature bergs, floating in Lake Michikamau. Almost throughout the length of the river there was the border of tangled Arctic willows, which grow to a height of six and eight feet, and in many places broom birch covered its low drift islands and shores. On the islands of Lake Michikamau and some of its more exposed points the spruces were sometimes dwarfed and distorted by the storms; and farther north, about the Height of Land, where the country is flat and boggy, the wood growth consists mainly of tamarack with small spruce interspersed, many of the tall, slender tops of the former being completely bent over, telling of the rigours of the climate.

Standing on a slight elevation near the Height of Land, I had the feeling of being at the summit of the world. The country seemed to fall away, especially to north and south. The line of the horizon seemed too near to be natural, and there was more than the usual realizing sense of the great space between the earth and sky. This was emphasized by the lifting of a far-distant hilltop above the line, as if in an attempt to look across the divide.

The middle source of the George River is in Lake Hubbard, immediately north of the Height of Land, so that it may be accounted to take its rise in practically the same latitude and the same longitude as the Nascaupee. Its course is west of north, and for more than fifty miles it consists of a series of lake expansions of varying sizes, whose waters drop from one to another down shallow rapids. About the lakes the country is quite flat, low ridges beginning to appear as we passed northward. Five miles below Cabot Lake the east branch of the upper George comes in, a stream apparently almost equalling the middle river in volume, and twelve miles farther down the west branch, which drains Attikamagen Lake near the Height of Land to the southwest. Ten miles beyond Resolution Lake the river drops

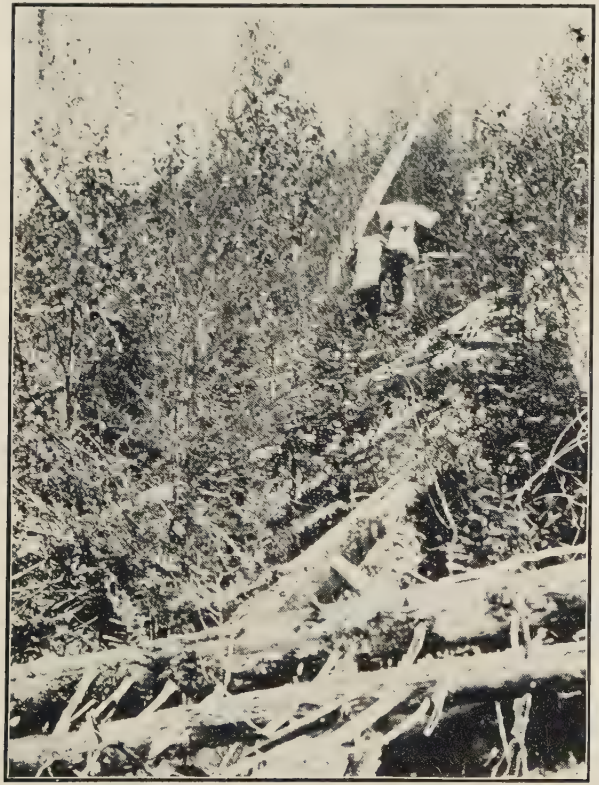


FIG. 4.—ON THE TRAIL. UP-HILL WORK, NASCAUPEE RIVER.

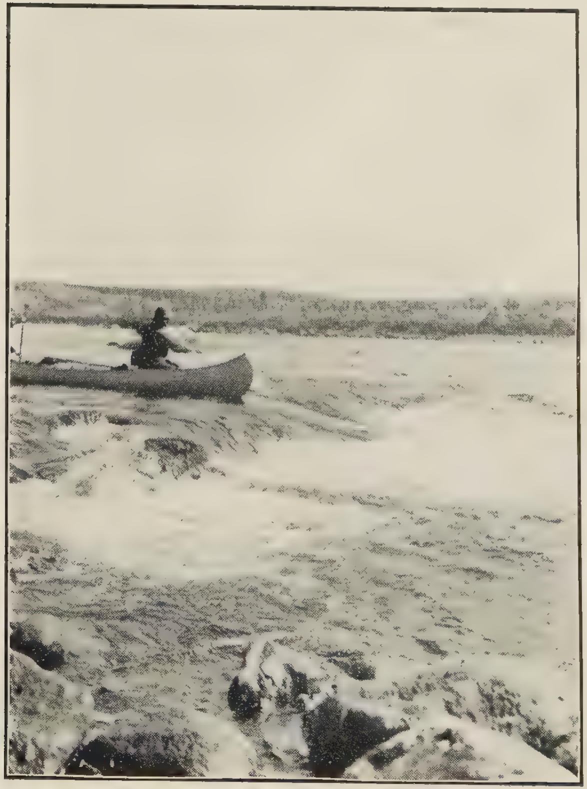


FIG. 7.—SHOOTING THE RAPIDS, GEORGE RIVER

down through three rocky gorges at Cañon Camp, the lake expansions of the upper country are left behind, and the George River now flows with strong, swift current in a distinct valley. From a few miles below the camp the country is burned over, and is exceedingly desolate, the hills being barren even of reindeer moss. These hills become higher, till below Thousand Island Expansion they rise between six hundred and seven hundred feet above the river.

The river here flows for about two miles in falls and heavy rapids round islands of pink-and-white rock, beyond which the descent is less precipitate. In the next six miles two heavy rapids occur, at the second of which the river descends to flow between high sand banks, the hills standing back some distance from its shores, their broken faces red with a coating of iron rust. The intervening spaces are strewn with boulders of unusual size. Some miles below a large tributary comes in from the west, the river turns abruptly northward among the higher hills and spreads to the Barren Ground Water.

This expansion is somewhat more than fifty miles in length and from one to two wide. It is shut in on either side by high hills, which in places on the east shore rise abruptly from the water edge, but on the west usually stand a little back from the lake, the intervening spaces being filled in with sand. Long, high, wedge-shaped points of sand and loose rock reach out here and there from the west shore, which in places slopes back to the hills in high terraces, the highest more than one hundred and fifty feet above the lake. Streams fall in from either shore at short intervals, but throughout the length of the river by far the larger contribution comes in from the east.

From the foot of the lake the George begins a swift descent to Ungava, flowing for more than one hundred and thirty miles in almost continuous rapids. The slope of the river-bed is in many places like that of a steep grade; and as the water swings past the long points of loose rocks which reach out from either shore, there is not only the slope down the course of the river, but a distinct tilt from one side to the other, as when an engine rounds a bend. There are foaming breakers where the water flows over its boulder shallows; but again the river is so smooth as to seem almost motionless, even where the slope downward is distinctly perceptible. A few small expansions occur where the hills stand farther apart, and in places serpent-like sand ridges reach in from the hills on the west. River terraces occur, those opposite Pyramid Mountains being particularly well marked. One of the most characteristic features of the lower river is the great wall of packed boulders thrown up by the action of the ice during the spring floods. Some of the rocks are of immense size, and usually the largest of them are found at the top. The wall varies in height from twenty feet at its beginning, thirty miles below the Barren Ground Water, to fifty and sixty feet farther down; and a short distance below our camp of August 24th a long bank of ice from three to four feet in thickness was still clinging to the boulders half way up from the water.

The country becomes more and more mountainous and rugged and barren. The wood growth, which is of spruce and larch, with, at intervals, a little balsam, is for some distance below Barren Ground Water rather more luxuriant than along the lake shores. At best it is but a narrow belt along the water, covering the hillsides to a height of perhaps two hundred feet, and dwindling gradually towards the north till in places it is absent altogether. The ridges on either side cross each other almost at right angles, turning the river now to the northeast, again to the northwest. Down the mountain sides broad bands of white show where the waters of numberless lakes and streams on the heights come tumbling down to join the river, and again a great gap in the solid mountain of rock lets through a rush of blue-green foaming water. The mountains on the right bank seem more rugged and irregular than those on the left, and Bridgman Mountains stand out to the river quite distinct and separate, like giant forts. The hills have the characteristic Cambrian outline; and it is the opinion of Mr. Low that this formation extends continuously eastward from the Kaniapiskau to the George.

Below Helen Falls the mountains spread in a wider sweep to the sea and the river gradually increases in width to its discharge into Ungava. Two heavy rapids occur below the limit of tidal influence which are obliterated at high water. At the foot of the lower of these there is forty feet of tide at the spring. In The Narrows beyond the post the outgoing water rushes in a long, smooth curve over an enormous boulder lying near the centre of the stream, to curl back in a great breaker the roar of which can be heard for miles. Ungava Bay has a spring tide of fifty feet, which at its rise fills the coves till below The Narrows the river is in places seven miles in width.

The game supply of the country traversed we did not find abundant, though it should be said no hunting was done off the route followed. On the lower Nascaupee our take consisted of a few porcupines, rabbits, partridges, and muskrats. There were signs of

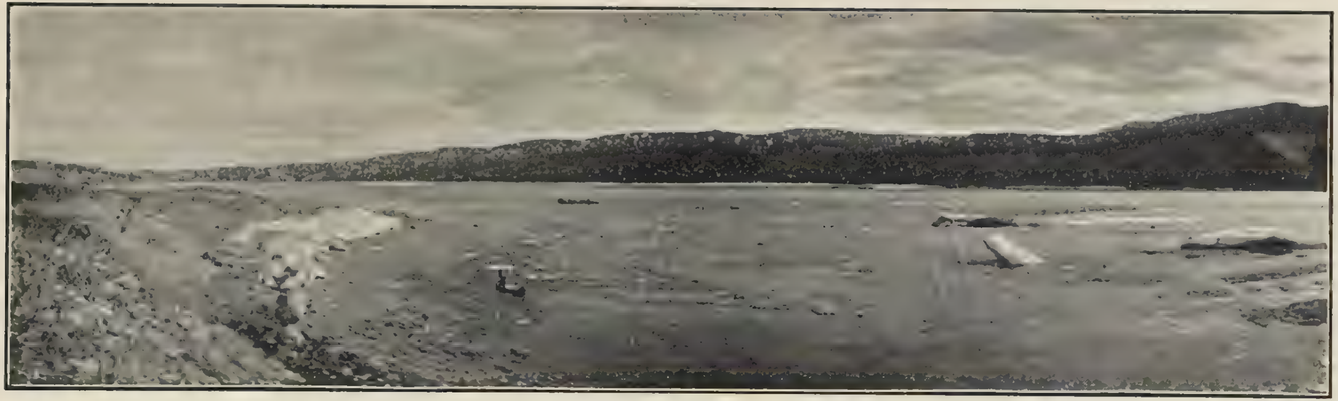


FIG. 6.—LOWER NASCAUPEE. SAND HILLS AND ICE BANKS.

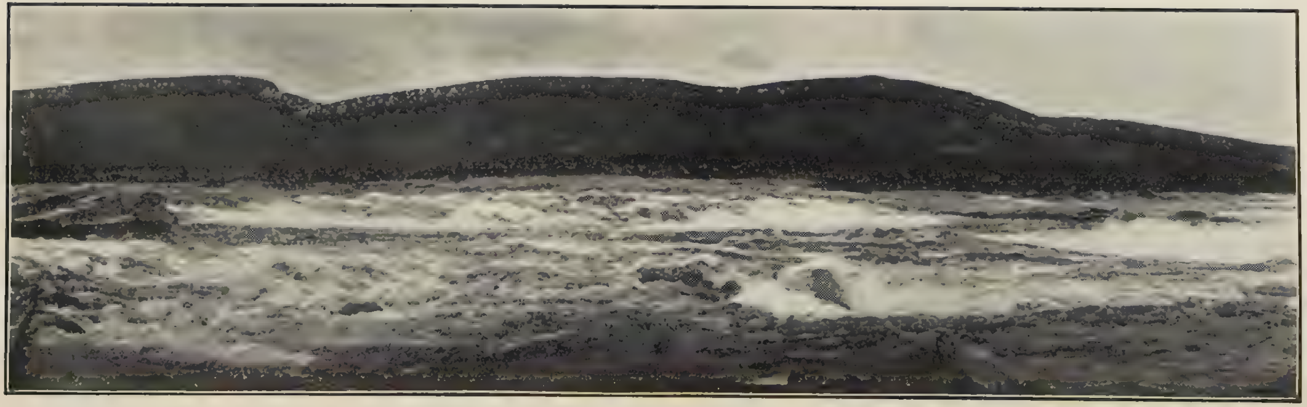


FIG. 8.—GEORGE RIVER RAPIDS AND MOUNTAINS.

beaver, marten, and otter, many bear trails, though we saw but one bear, a black one, and only once on the lower river did we see fresh caribou tracks. Seals played at the foot of Three Mile Rapid, and later we saw a number of them in Seal Lake and above Seal Rapid. On the upper river a few black ducks, Canada geese, spruce partridges, willow ptarmigan, were taken, and two days' journey above Seal Lake our first caribou.

On the west shore of Lake Michikamats, August 8th, we came upon the caribou migration, and saw one herd in which there were thousands. Though we did not again find them in such numbers, yet for fifty miles of our journey they were seen in smaller herds every day, and sometimes many times a day. They were in summer dress of pretty brown shading to grey and white on the under parts. The antlers were in velvet and of immense size, and males and females were already herding together. Apparently they had been in occupation of the country for some time. From Ptarmigan Point, on Lake Michikamats, to the head of Long Lake, on the George River, the country was a network of their trails, in the woodlands and bogs cut deep into the soil, on the barren hillsides broad, dark bands converging to the crossing-place at the river. North of the Height of Land we passed at intervals long piles of whitened antlers; and along the shore opposite our camp of August 15th, a broad band of white caribou hair, four feet above the river, told of their crossing and recrossing while shedding the winter coats.

Only once in passing this part of the country did we find trace of their enemy the wolf. Throughout the journey we did not see any, but once, while running down the lower George River, a lonely cry came down to us from one high up on the mountain side.

Through the caribou belt other game was more abundant also. Every day mother ducks with their flocks of little ones were seen, and a number of geese were taken. Gulls and loons were there in numbers, and ptarmigan were very plentiful as far as the head of the Barren Ground Water; but beyond, none were taken till we reached the post. Along the lower part of each of the rivers signs of foxes in large numbers were found, and the lemmings on which they feed made us not a little trouble. They were about in thousands, and the ground was so perforated with their holes as to remind one of a porous plaster.

In the lakes fish seem abundant, though we travelled too fast to do much fishing, and the nets were not once in the water. In the lakes are the brook trout, ounaniche, and namaycush, some white fish, and in the lower George the sea trout and salmon.

The flowers are beautiful, though not so varied as in the home country. All along the Nascaupee blossoms of the Labrador tea filled the air with their fragrance, and pale laurel grew in abundance. Now and then we crossed great beds of blossoming cloudberries, and everywhere the star flower and bunchberry showed their white blossoms. One day, while ascending the Wapustan River, Gilbert handed me a dandelion, and during the day I saw several of them, but did not again find them throughout the journey. On the upper Nascaupee the dainty pink bells of the low cranberry showed in the carpet of glossy green, and near the water, along the low drift shores, the pink, almost rose-like, blossom of the dewberry. Violets grew on both rivers, but most beautiful of all was the twin flower, which I first found growing on the sandy terraces beyond the hill country west of Seal Lake. It was the delightful fragrance which first attracted my attention, and looking down I saw the long trailing vines from which the pink twin bells are lifted on slender, hair-like stems. It grows even more abundantly on the sandy shores of the George River, and at the post at Ungava masses of this beautiful flower, so rare and treasured here, creep along the foot of the mountain, while indoors, in a pot on the windowsill, Mrs. Ford, the agent's wife, carefully treasures two tiny clover plants, in her eagerness almost afraid to believe that they are really clover.

During the journey, which occupied the two months from June 27th to August 27th, the weather was wonderfully fine. There was not the continued downfall of rain nor any of the extreme heat, which told so heavily against Mr. Hubbard in 1903. We were in camp only eleven days on account of the rain, and the highest temperature reached was 77° F. in the shade. The lowest recorded temperature was 30° F., which was not, however, the minimum reached. As we passed into the higher lake country the clear nights were frosty, and on the morning of August 10th, at the northern extremity of Lake Michikamats, there was a coating of ice an eighth of an inch thick on a basin of water left outside the tent overnight. While descending the upper George my duffle was sometimes frozen stiff when I came to put it on in the morning; and on August 13th, 14th, and 15th we had snow flurries, as well as heavy rain and wind.

Thunderstorms were rare, and very mild as compared with those in the United States. On many days which were very beautiful there were passing showers, and Labrador is a land of rainbows. Nowhere have I ever seen their colours so brilliant or so variedly

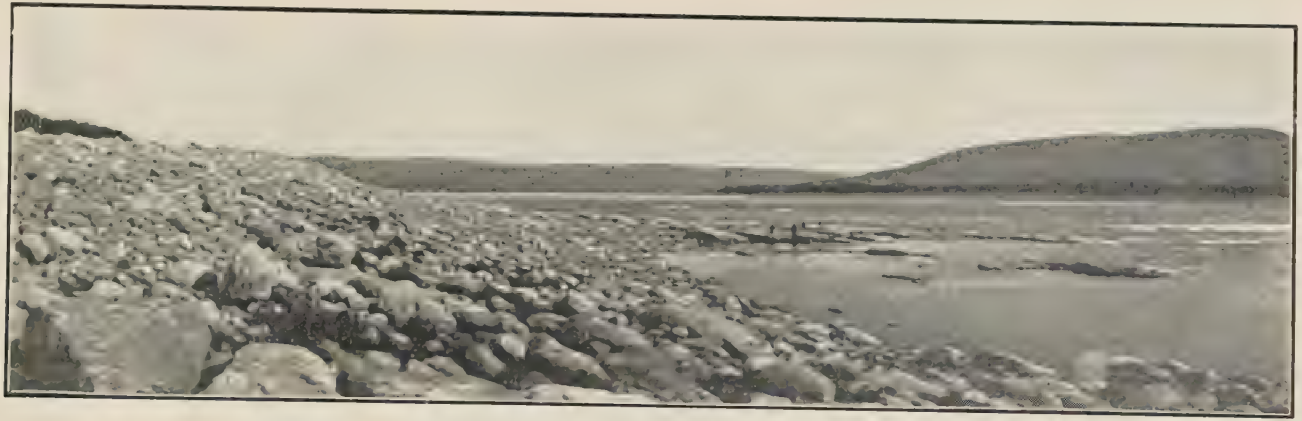


FIG. 9.—WALL 50 FEET HIGH ON LOWER GEORGE RIVER.

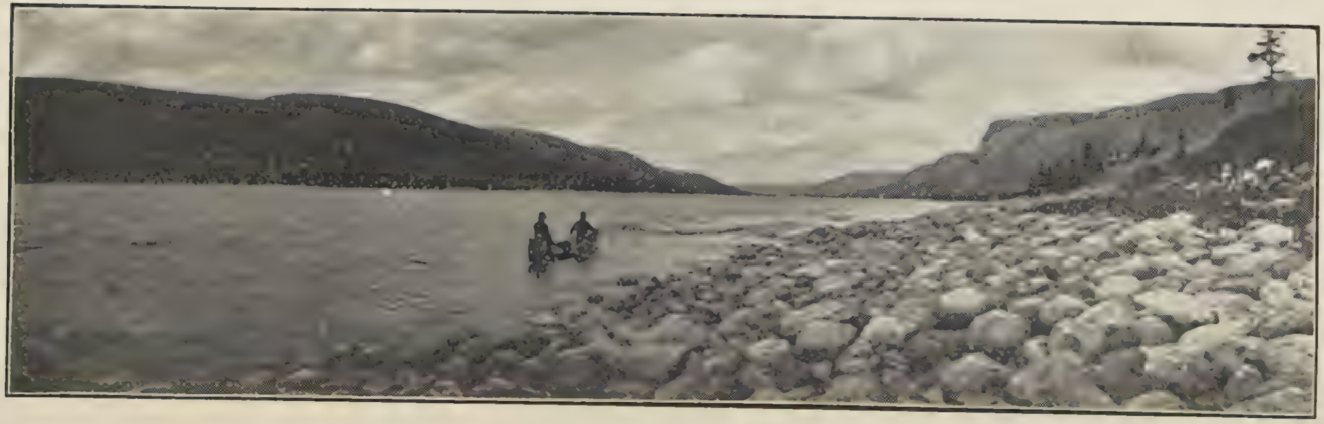


FIG. 10.—BRIDGMAN MOUNTAINS, LOWER GEORGE RIVER.

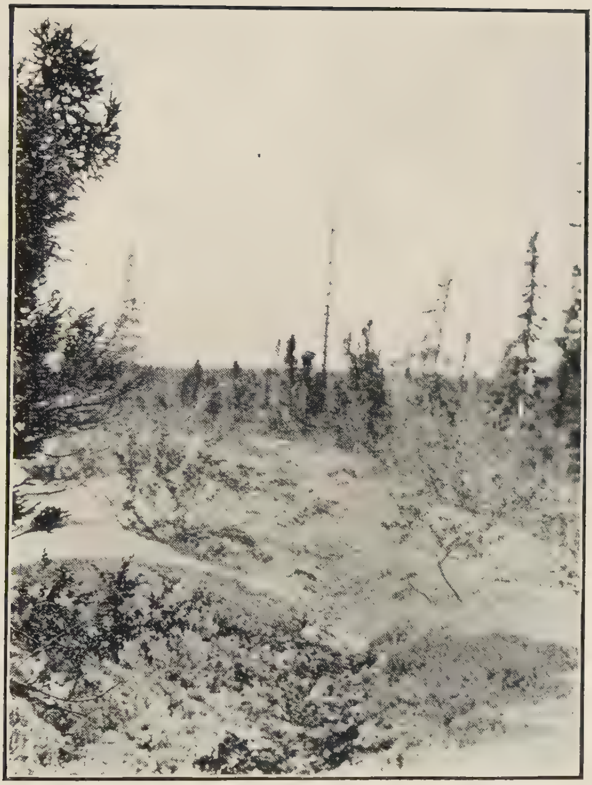


FIG. 11.—CARIBOU TRAIL, PTARMIGAN POINT, LAKE MICHIKAMATS.

manifested. They did not always appear in the form of a bow, and once I saw them lie like a beautiful veil along the whole length of Rainbow Hill on the upper Nascaupee. There was a wonderful clearness in the atmosphere, which made landmarks miles away seem very near and clothed the far-distant hills with colour indescribably beautiful. In the blue of the hills and the waters and the sky there was a peculiar silveriness, which, with the white of the reindeer moss and the dark green of the spruce forests, touched in places with tender green of the white birch and poplar, made a combination of colour which I think can scarcely be surpassed in beauty anywhere in the world. In a way which I could neither describe nor understand, it was comforting.

The flies and mosquitoes, for which the country is famed, did not wholly fail of accomplishing their dire designs upon us; but their ravages are easily forgotten in the remembrance of the beauties of that lone land which can smile with so much grace, even though its mood has sometimes been one of such persistent cruelty.

IMPRESSIONS OF A NATURALIST IN BRITISH GUIANA.

BY

PROF. ANGELO HEILPRIN.

When in 1825 Charles Waterton published his delightful "Wanderings in South America" he gave to the world the first picture of what Anthony Trollope has called the "true and actual Utopia of the Caribbean Seas, namely, British Guiana." In it we have presented one of the most fascinating introductions to a region of charm and beauty—an impression of nature which is scintillant with the glories of the field and forest, that mocks, however rudely, the labour of the systematist and cabinet, that invites to hidden secrets in a largely unknown world. The "Wanderings in South America" has doubtless been to many one of the earliest books of travel to inspire, and it has always seemed to me to be the impelling force which through many years has held up the vision of a journey to the great primeval forest of the south. Therefore, to its author *nominatim* I surrender "a certain portion of the honours" that may come to me from my recent and exceedingly modest journey; for, as he says, "As Ulysses sent Achilles to Troy, so I sent him to Guiana."

If Surinam, the close neighbour and parent of British Guiana, can be properly likened, as has been done by Palgrave, to the Biblical paradise simply because it is "a very pleasant place" and not over-progressive, so, for like reasons, the comparison might be extended to cover the British colony, in which the moulding of man and his methods sees before it a long future. The similarity, if it does not extend much beyond the two conditions which it specifies, has other elements that may be thought to justify a comparison. A free, untrammelled Nature tends toward *paradisism,* and there are few regions of the earth's surface where the encroaches of man have done less to modify wild nature, or to take from it its majestic solemnity and grandeur, than the wilds that stretch in one almost unbroken sweep from the mouth of the Orinoco to the lower basin of the Amazon. It is here that the great primeval forest, the almost pathless solitude that has made classic the descriptive writings of Humboldt, Von Martius, Schomburgk, Bates, and Wallace, still gathers in its darkness from a region of almost no trespass, and unfolds itself in a magnificence that is perhaps not to be matched elsewhere. The continuous forest of the Amazon-Orinoco basin covers not less than 2,000,000 square miles, and, it may be, considerably more, and in its region of vast trackless woods there is hardly a gateway to the interior, barely a road or path, and virtually no line of travel-communication except where nature has set those water-highways which, even as secondary rivers, pour out their waters in volumes exceeding those of the Volga, the Danube, the Rhine, or even the Mississippi.

Most travellers receive their first impressions of British Guiana on their arrival at the capital city, Georgetown (more commonly designated from the country in which it is situated, Demerara), but before this, and for many miles out to sea, he will have noted a characteristic of the land in the yellow-brown waters that lie outside, the sediment that rolls out in floods or is gathered in from the discharge waters of the Orinoco. The Amazon seems to have little part in this discoloration; for, if my information is correct, much of the off-shore of French Guiana and the land lying still farther to the eastward are bathed by a clear sea. Back of the fringe of muddy water the eye follows the low contour of a bordering grove of mangrove, and beyond it in some places, or replacing it elsewhere, the glass may resolve a somewhat loftier growth of willow-like bushes, or even trees, the courida (*Avicennia nitida*). In the distance, less lofty than the occasional chimney that tells where the sugar-cane is being grown, or where it was cultivated until competition with the sugar-beet broke the back of the most important, albeit steadily failing, industry of the colony, are a few specimens of the royal and cabbage palms (*Oreodoxa regia, Oreodoxa oleracea*), and the landscape is virtually complete. There is not a rise in the land that even remotely suggests a hill, and it is in faith only that the mind constructs the landscape of lofty mountains in the far interior. Nearing the land, a space of some three-quarters of a mile between the growths on either side invites to where the Demerara River opens out to sea, and on the river, a short distance up the right bank, lies Georgetown.

The capital city does not particularly concern the naturalist, except for its botanic garden and experiment station, its charming avenues of trees, and the open water-ways, the so-called "canals" of the city, which are magnificently grown with the *Victoria regia* and the equally beautiful large-flowered water-lily and lotus. I had heard much of these open canals, but rarely a word regarding their attractiveness. Residents of the city are habituated to this display of floral wealth, but to the newcomer, to the one who knows these glories of vegetation only from the isolated specimens in botanic gardens, the spectacle is a ravishing one, however closely it may be associated with the prosaic topic of city drainage.

From the moment that the traveller has set foot on Georgetown soil he has made friends with that lovable and seemingly always cheerful laniine bird, the kiskadee (*Pitangus violaceus*). *Qu'est-ce-que-dit?* comes from the tree-tops overhead, from orchards and gardens, and from your hotel window-sill. Throughout all the hours of day and through many of the hours of semi-day this sprightly interlocutor plies his little inquiry, not waiting nor caring for a reply. In that part of town which insensibly removes to country, a more direct call upon the stranger may be made in the quizzical and surprisingly human "Who-are-you? Who-who-are-you?" of the native whippoorwill—a voice which, when once recognized, brings back pleasant memories of lands far away.

Georgetown is by no means a featureless city, and those who assume that decaying colonies must necessarily have their representation in centres ranking equally with them in decay will regard with more than respect the stately Government Buildings, the Law Courts, the market-house, the Club, the numerous large commercial houses—where, repeating a characteristic of many business-houses the world over, everything may be had from a needle to a church-steeple—and, above all, the inviting tropical houses that lie back in cool and shaded gardens. An effective system of trolley-cars ministers to the wants of a very large part of the 60,000 inhabitants, by far the greater number of whom are blacks, and a smaller number East Indian coolies. The whites, who constitute about three-fourths of the entire white population of the colony, number less than six thousand. Georgetown is in outer dress more attractive than either Bridgetown, in Barbados, or Port-of-Spain, Trinidad, although from the peculiarities of its geographical location it can lay no claim to scenery as part of its composition. Although my visit was timed for the months of March and April, and therefore to the period when the sun was in one of its summer positions and virtually overhead, the highest shade temperature that I saw recorded was only 87.5°, between midday and 2 o'clock in the afternoon. At this distance, therefore, of only little more than four hundred miles from the equator the extreme temperature was below that which I had observed on the Yukon River, on or near the Arctic Circle. The evenings were invariably delightful, and their refreshing quality made man a willing servant to work on the morrow.

The Exuberance of Animal Life.

In the low savannah country that for miles extends backwards from the sea-border, and frequently assumes the garb of flooded meadows in which houses appear like floating arks and where man displays his amphibious instincts in a way to remind one that roadways are not always the determinants of direction in travel, the naturalist is brought face to face with that exuberance in animal life which is the day-dream of tropical nature. Hundreds and thousands of the white ibis fleck the meadows with their slender forms. With them are spoonbills, herons, and bitterns, and myriads of the little reed-bird (*Xanthosomus icterocephalus*)—the whole a bird paradise. The graceful little spur-wing or jaçana (*Parra jaçana*) is everywhere busy in the grass-copings and sedges, apparently unmindful of the watching eyes of hawks and harriers, which appear to be in every bush and tree. They plume themselves along the driveways, or sit gravely on branch or fence-post, taking no notice of the passer-by, no more than the passer-by takes notice of them. This quality of unconcern is charming in its relation to association, and gives an opportunity to the observer to make his investigations at close range. A large-sized manatee was disporting in a pool immediately back of the railroad station at Belfield, where we were waiting for a passing train, and it, too, seemed to be wholly indifferent to the people who happened to be near-by.

The abundance in which the birds were about naturally made one eager for the chance to see the rarer types. While speeding over the savannahs my eye caught sight of three individuals of the great American adjutant or jabirú (*Mycteria Americana*), "negrokops" as they are here styled, so peacefully meditating that one might have thought them posed by a photographer. The naked branches of the lofty ceiba or silk-cotton tree everywhere hang with the purse-nests of the *Icterinæ*, twenty to fifty, or more, in number, all gently swaying in the breeze that catches their lofty position. Some of these nests, notably of the *bunya*-birds (*Ostinops decumanus, O. viridis*) measure at times five feet or more in length, and are marvels in delicacy of construction. Storm and rain may come, but the little ones still swing in placid security in their dizzy heights above. The thinking naturalist, despite all theories of birds' nests, must continue to ponder over the evolutionary process that shaped the destinies of these remarkable constructions.

At Buxton, a small hamlet a few miles from Georgetown, where I was for some days serving a most pleasant guestship, there was nailed over the passageway between the verandah and the interior sitting-room of my host's house the skin of a large water-kamudi or anaconda. It measured 20 feet 7 inches in length, and opened out to something more than two feet. It was thus a large animal, and I naturally assumed that it was a trophy obtained from the chase in some deep interior part of the colony. But my host informed me that it met its fate as a transgressor at a distance of only 150 yards from the house, and that hardly more than a twelvemonth ago. The largest authenticated specimen of the anaconda coming from the colony appears to have measured about 29 feet in length.

On my first walk out from my host's house, a late afternoon family stroll, we chanced upon a specimen of the crab-dog (*Procyon cancrivorus*), which was being pursued in true raccoon-hunt fashion by a horde of negro boys and scatterlings. Poor creature, its broken back did not permit it to make either a vigorous defence or a graceful flight. On the morning following a living specimen of the crab-fox (*Canis cancrivorus*), its feet securely tied together, was deposited "on sale" on the porch steps. These instances of close neighbourship will show how delightfully situated the zoölogist may be who chances to visit this region. He will not lack for material, although it can well be that at times this material may be found too close at hand. Returning early of an evening from a tennis-party, driving homeward, we found the road momentarily blocked by a not entirely ignoble specimen of alligator, whose domain extended to the waters of a bordering canal. It was one of numerous denizens of the water-ways of the region; but of such the inhabitants take little count, and allow them to work out their own salvation. The alligator, as distinguished from the less common cayman, rarely attains a length, as I understand, much exceeding seven or eight feet.

The Mighty Rivers.

Lest the geographer become too thoroughly impressed with the notion that the great rivers of the globe are only those that serve as trade-carriers or have played a familiar part in childhood's study of geography, it may be noted that in this distant forest-land are rolling waters that would shame the rivers of Europe—that would put to a long test even the "Father of American Waters." The great sweep of the Corentyn and Essequibo, rivers that 60 miles or more above their estuarine mouths measure from three to four miles in width, and which for yet a further hundred miles may still carry two miles, is an object-lesson in geography which impresses with more than ordinary force. Let the traveller stand at Bartica on the Essequibo, where the waters of the Mazaruni and Cuyuni are mingled in with those of his own stream, and he will no longer wonder why this region is sometimes called in one of its Indian tongues "the land of many waters." From far off, like unto the picture which the master of "Thanatopsis" has given of the Oregon, roll in the waters of these mighty tributaries, threading the mazes of the dark forest that falls to their banks, and leaping in silver sheets of foam through the scarred rocks that here and there interpose as cataract-walls. Nearly all of the major streams of British Guiana are now freely and regularly navigated by small steamboats and launches, but obstructing cataracts do not in most cases permit of continuous navigation for more than 70-125 miles. Above the reach of tumbling waters, nearly all of which are passed downward by paddle-craft, middle-course navigation has been established in some cases, so that without difficulty the traveller may penetrate a far way into the interior. The Corentyn, Berbice, Demerara, Essequibo (with some of its major tributaries), and Barima have all their little passenger craft, and they afford an entrancing way of studying scenery and the general characteristics of the country.

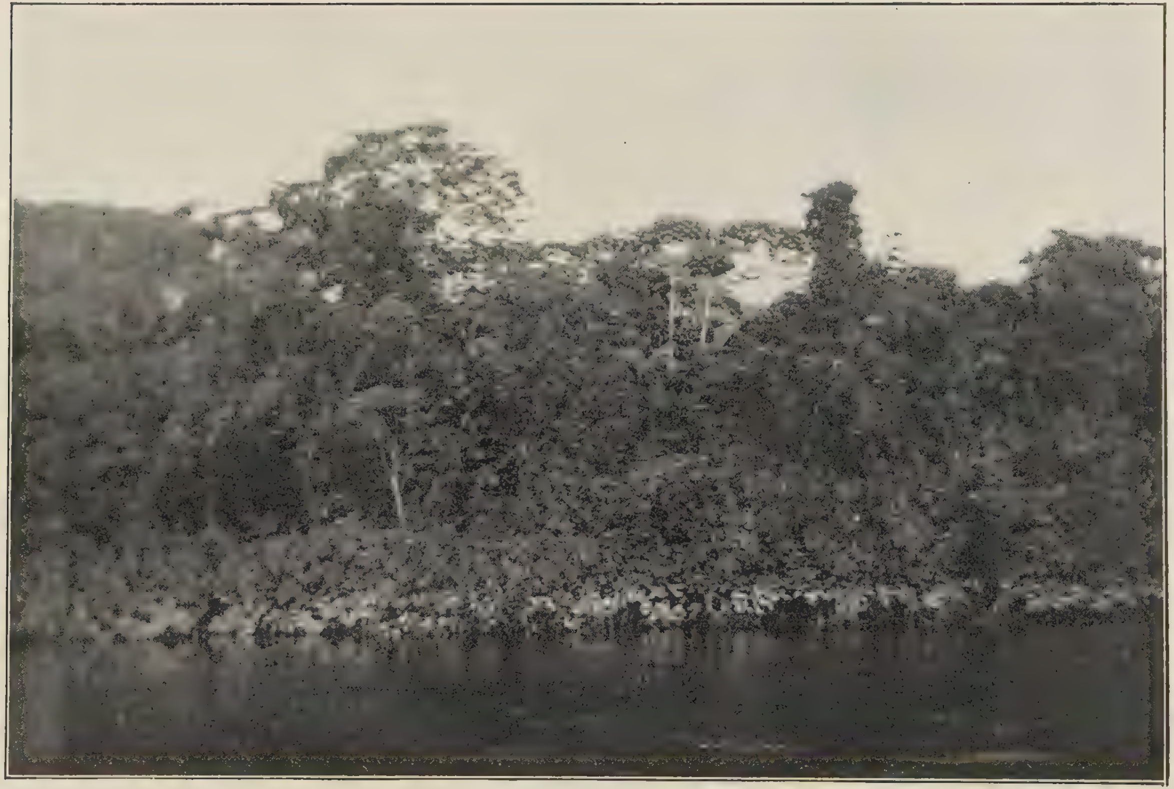
My own main journey was made by way of the Demerara River to Wismar, thence by rail across a line of inner sand-dunes—the ancient sea-beach, still attested by the presence of shells which are identical with those found on the ocean front—largely overgrown with the trumpet-tree (*Cecropia peltata*), to Rockstone on the Essequibo, and from Rockstone (which lies a short distance above the head of a long line of rapids) to within a few miles of the Potaro River. The Demerara, in its course of about 70 miles to Wismar, presents scenery of only a mild type, but a veritable moving picture of life. The vegetation that borders it is rankly tropical, but what there is of woodland or forest is probably wholly of second growth. Great thickets of canna, of the giant-leaved "muck-a-muck (*Montrichardia arborescens*), and cane grow out of the river's banks, and with other plants form so dense a fringe to the water that a land-surface is rarely to be seen, not even to a stray rock or pebble. The tier of thicket that rises back of the river-fringe is a vast conglomeration of green, in which the eye notes here and there clumps of eta (*Mauritia flexuosa*) and suwarri palm, of the more graceful cucurrit and manicole, the grey-barked and nearly naked-branched ceiba, with its swinging nests of cassiques, the lofty (*Mora excelsa*) purple-heart, and a mass of other trees all roped and matted together, and densely shrouded in upper growths of aroids, bromelias, and orchids. Tiny hamlets, some of them only visible in a few scattered houses, in a detached church, or in a country-store bearing the name of Chinese proprietorship, here and there peer out from the canopy of vegetation, or give evidences of existence in growths of bananas and cocoanut. But at all the "landings," which with few exceptions are made moving in mid-stream, in the manner of landings on the Rhine, you have plenty of folk—men, women, and children, mostly black or brown—come out to meet you, to gather in what is desired for debarkation at their "ports," or to take passage for some farther point on the river. At such meetings a generous flow of language usually acts as a stimulant to what intercourse is provided. The number of native boats that ply on the river is very large, and at nearly all times some of these—whether the simple dug-out or pirogue ("corial") or the banana-leaf sheltered scow and flat-boat—can be picked up along either shore. They transport fruit, dyewoods, baskets, wooden-ware and charcoal, some coming from far inland, others from the tributary waters that discharge under forest archways, so thickly screened by hanging and climbing plants as to be all but lost to the unaccustomed eye.

Throughout nearly the whole of the river-journey individuals of a species of fork-tailed swallow (*Atticora melanoleuca*) would take refuge in a locker under the roof of the steamboat's deck. They came in twos and threes, would stop for a while and then be off again, wholly unmindful of the presence of man. Beyond these creatures there was little of animal life to be seen. Some bitterns and a few steel-blue kingfishers would at times flit across the water, and occasional stray parrots, easily recognized by the rapid, short movement of the wings and their flight in twos, might be observed gambolling among the loftier tree-crowns; but in general it was a quiet nature that prevailed, and there was little to suggest a struggle for existence.

THE FOREST PRIMEVAL OF THE ESSEQUIBO.

Just beyond Rockstone, where a line of stately eucalyptus trees leads up to a modest but well-kept hostelry or bungalow built on the edge of the woods, the Essequibo opens out into a superb expanse, with the lofty forest primeval breaking down in curtained walls quite to the river's brink. It is here, where civilization is left behind, that one learns to appreciate what wealth of tropical vegetation really signifies, and how meek and lowly, even if lovingly beautiful, is the vegetation that in the north we ordinarily conceive of as being luxuriant. Little wonder that the botanist Richard Schomburgk wrote in raptured ecstasy his description of this wonderland, that his eyes felt continuously hungry for new marvels of forest creation. Fifty years and more have elapsed since the journey of this naturalist was undertaken, but the wilds of British Guiana, save for the tiny steam craft that move up and down the rivers, puffing out their long lines of smoke, and for a few gold-holes and a few clearings made around gold-prospects, remain the same as they were in the forties—untraversed by paths, uncut, and forbidding, as they will still continue to remain for many years in the future. The sweep of water extends out from one to one and a half miles in width, here and there enclosing islands large and small, but everywhere with virtually unbroken walls of vegetation to mark its limiting borders. There are no longer hamlets or houses, no more clearings or cultivated patches; hardly a boat glides upon the placid surface of the dark waters. The majesty of nature is held up in its half-silent wilderness, in the sea of green that in towering masses teaches a lesson of humility—that tells the inconsequence of man. For a journey of upwards of seventy miles we saw no break in the forest, save where tributary waters come to join the parent stream, parting the wilds now on one side, then on the other.

He is, indeed, a fortunate traveller who can make clear to him-



Phot. A. Heilprin.

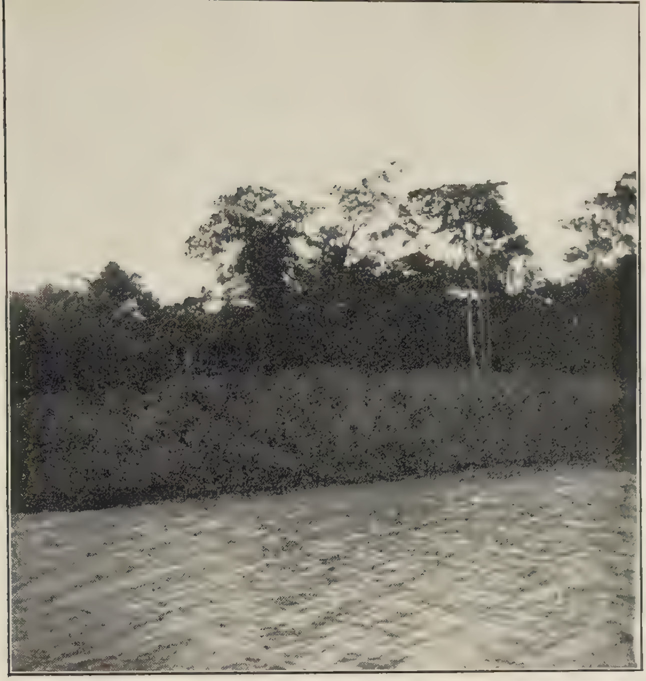
FIG. 1.—THE PRIMEVAL FOREST OF THE ESSEQUIBO RIVER.

self the components of this forest vegetation. We recognize the uplifted crowns of the mora, of the purple-heart and greenheart, here and there the feathery tufts of different palms, occasional fronds of giant tree-ferns, or the buttressed trunks of the ceiba; but what are these to the vast assemblage of forms that are a secret to all but the professional botanist or that have yet to receive a name? The eye follows wonderingly the long lines of swinging and festooned lianas or bush-ropes, searches the rugged and scarring growths of air-plants that shroud the upper tree-trunks, and then falls upon that wonderful outer tunic, the curtain of creepers, that overgrows all, and, hanging terrace-like from crown to root, keeps to itself the mystery of the interior.

The wall of vegetation maintains a generally uniform height of 125 to 150 feet, with projecting crowns occasionally rising 20-30 feet higher. It is this great height, so difficult at first to realize, which makes the solemn grandeur of the equatorial woodland. The eye fatigues in following the tree-trunks to their lofty terminations, and where it has been finally set at rest it only half sees through the intricacies of foliage that bound its path. The forest, although very densely matted on the absolute water-margin—so much so as to make a footing almost impossible in many parts—is not strictly impenetrable even in the ordinary descriptive sense; for, once away from the water, the barrier of creepers largely disappears, and the undergrowth progressively thins out. But it is only at rare intervals that the machete or cutlass can be dispensed with.

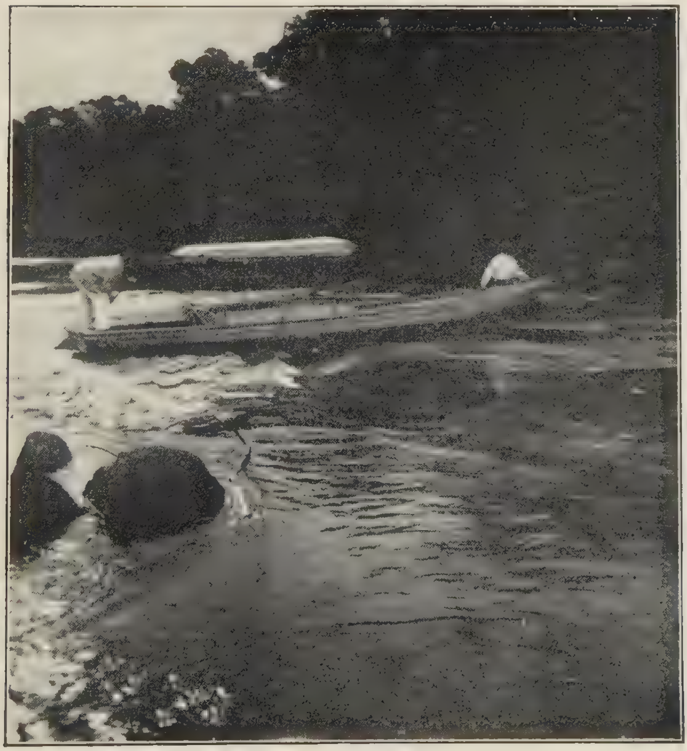
Although the general colour effect of the outer wall of the forest is that of an intense green, there are, nevertheless, many interchanges of brown, russet, and silvery grey—the expression of seasonal change, more or less corresponding to the autumnal changes in our own vegetation, in the foliage of certain groups of plants, I believe for the most part *Leguminosae;* but there were few trees or bushes that were destitute of leaf-covering—a marked contrast to the "winter" vegetation which I had before observed on the plains of Yucatan, or to that which I found in the middle of April on the slopes of the outer Andes between La Guaira and Caracas. I was surprised to find here and elsewhere in the forest so few fallen monarchs and generally decaying timbers—a striking contrast to the picture of our own north woods. What became of the trees that had passed their years was not always apparent, but the silent, destructive work of the little termite tells at least a part of the story. They grind down to powder, and stand as messengers to assimilate the living with the dead.

The average student or reader is apt to picture the tropical wilderness with an aspect wholly different from that of the forest of deciduous trees of the North. Strange forms in foliage are calculated to impress the mind in a particular way, and to give a distinctness to contour which is largely or wholly wanting elsewhere. And, were it possible to unite into one picture the varying and more distinctive patterns which the different groups of plants exhibit, the composite would be truly a picture such as one generally sees in sketches of tropical scenery. Truthfully, too, one may say that such pictures in Nature do exist, as, for example, in the deep valleys of the islands of Dominica or Martinique, where the cannas, the heliconias, the tree-ferns, bamboos, and palms are not only distinctive physiognomic types, but occur in such numbers and in such positions as to make the landscape conformably physiognomic. This is not the case with the forest of Guiana, where the types of vegetation that might be thought to be physiognomic in the broad characters which they present are so far overshadowed by the types that are not particularly distinctive that they lose themselves as determined or dominating figures in the landscape. The palm, for example, which perhaps most people would assume to be the one great distinctive feature of the vegetation of the tropics, is here completely lost, for its tufted crown does not generally rise to more than one-half the height of the great wall of the forest, and even in clumps it is frequently difficult to distinguish. The major part of the woodland, when not too closely scanned or when studied in mass, has an astonishingly northern aspect, the aspect of the woods which are familiar to us in the types of the locust, the laurel, beech, elm, and walnut. This broad resemblance has been clearly pointed out by Im Thurn in his work "Studies among the Indians of British Guiana," and doubtless has suggested itself to many other observers. When, however, a closer study is made of the components of tropical vegetation, when integrals are examined in place of aggregated masses, the resemblances to northern types, however strong they may yet appear, give way to differences that are far more pronounced in their appeal to the eye. It is in the interior of the forest that we learn to read the architecture of the vast structure that is about us—to approach with awe the giant buttressed trunks of the mora, the ceiba, the *Eriodendron*, or *Ficus*, to gaze with wondering delight upon the wealth of vegetation that in shrouds, in festooned lines and garlands, form the upper



Phot. A. Heilprin.

FIG. 2.—FOREST OF SECOND GROWTH ALONG THE DEMERARA RIVER.



Phot. A. Heilprin.

FIG. 3.—PULLING THROUGH THE RAPIDS OF THE ESSEQUIBO.

vegetal zone. It is no longer the land of the North, but the land where summer skies are a continuous day. The impressiveness of Nature is here at one with its glories, and man stands and contemplates in silence.

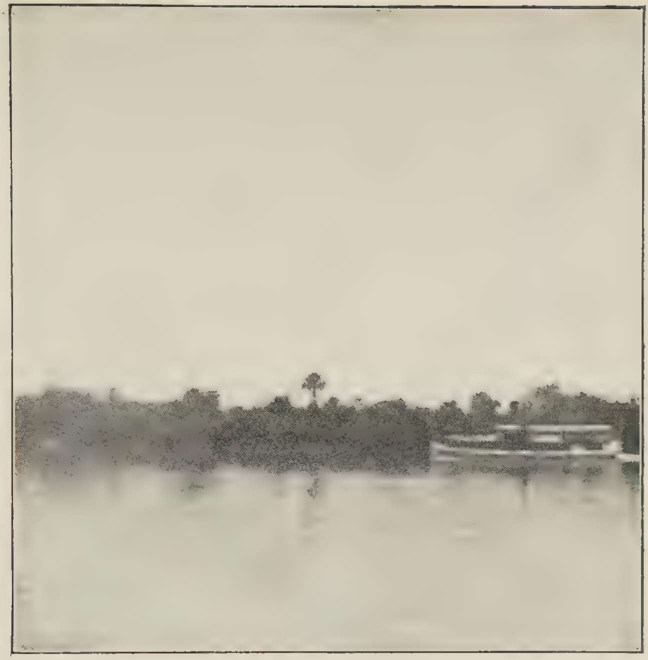
It may not be easy to take the full measure of beauty of a tropical forest; nor indeed, despite its extraordinary wealth of vegetable forms, need it command a higher or more satisfying degree of admiration than the sunlit leafy woods of the North. The forest of the South, rank in growth and illuminated by hardly more than flashes of sunlight, may be thought by many to be oppressive in its grandeur; it is forbidding rather than inviting, for there are no opening glades or vistas of moss-grown retreats, no soft carpets of grass or flowering banks, no receding lines of tree-trunks, to throw dimming shadows into the interior. Everything is grand and majestic, built on a plan to be awe-inspiring rather than pleasing, to evoke admiration rather than to delight.

Mr. Wallace, in his illuminating writings upon "Tropical Nature," has laid emphasis, in a contrast between the forest of the South and that of the North—or, indeed, between the vegetation generally of the two sections of the globe—on the marked absence in the former of showy flowers, of that display which we recognize in the glory of a field of clover, or daisy and dandelion, and in the blossoming crowns of the apple, the pear, and the cherry. The traveller, he remarks, may wander for weeks among or about the wilds of the Amazonian solitudes without once having his attention attracted by showy flowers. The wilderness is green, severe, and unrelieved by colour. One cannot absolutely accept this picture, albeit it is framed by one whose years of observation in the equatorial regions entitle him to a degree of consideration which falls to the work of but few naturalists. Mr. Im Thurn, in the work already referred to, has taken distinct exception to Mr. Wallace's characterization, in so far as it relates to the water-front of the Guiana forest. A display of flowers is here by no means exceptional, and I question if there are many areas of northern woodland which have more, or even as much, to show. One cannot readily forget the patches of blue and purple *Passifloraceæ* which cover in sheets the outer tunic of the forest, the blazes of white and yellow acacias, or the intensely scarlet wheels of the *Rhexia*. These may not be more beautiful or attractive than the exquisite flowers of the rhododendron, the mountain-laurel or dog-wood, but are they much less? The northern woods, in fact, are not in themselves ordinarily prolific in a display of flowers. It is in the open fields and waste-lands that we find that floral aggregation for which, I believe, one searches in vain in the tropics.

THE LIFE IN THE WILDERNESS.

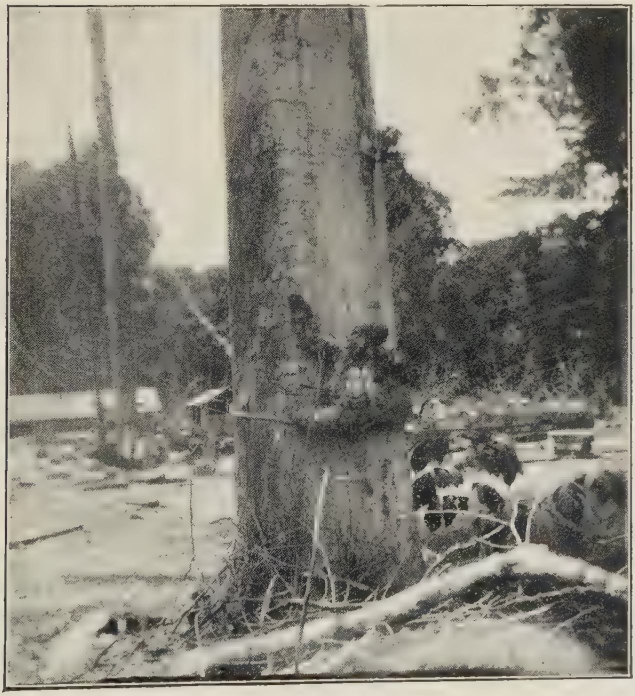
It is, perhaps, a commonplace observation that life is prolific in the southern "bush." Yet, be it so or not, there are some who choose to believe that these wilds are impressive in their silence, by that hushed nature which is a part of the Polar tract. The deep forest interior may in places wear this character of desertion and loneliness, but elsewhere it plays true to the world which inhabits it, and resounds in joyous sounds and uproarious tumult. Let the stranger place himself on the borders of the forest at almost any point of the river and he may be certain sooner or later to become party to a woodland chorus for which he will have been but ill prepared. It is the voice of the red-howling monkey that he hears—perhaps that of a single individual, or it may be of a whole troop; but either way it is a voice of no gentle cadence—a roar that yields in little to that of the lion. The forest is seemingly in tumult, ringing with a desolating cry; but presently one hears only echoes, and for a while everything may be quiet. It was my ill-fortune not to see any of these monkeys, or, for that matter, any other form of monkey; although fairly abundant, and seemingly always prepared to lend their voices to the night, they managed to keep out of my way and sight. I am told, on what seems to be reliable authority, that on perfectly still nights the fracas caused by a single individual howler may at times be clearly heard at a distance of three or four miles, or even more.

Alexander von Humboldt, in his essay on the "Nocturnal Life of Animals," refers to the fitful roar of the American lion. I did not at any time hear this sound in the southern wilds, although acquainted with it in the North, nor did I once come upon the tracks of the animal. On our launch journey up the Essequibo we had occasion to notice a beautiful specimen of the black jaguar, or Maipuri tiger as it is here called, which was leisurely pacing a sand-pit that the river had thrown up. The animal had come out of the forest, and may have been following a trail of capybaras (*Water-haas*), several individuals of which had but a few moments before come down to the water's edge. This rodent seems to be the favourite food of the "tiger" in these parts. A large spotted cat, reported to be a jaguar but which may have been an ocelot, visited a mining clearing (where I was staying as a guest), back of the Omai, a few days later, but beyond causing a momentary



Phot. A. Heilprin.

FIG. 4.—ON THE LOWER DEMERARA RIVER.



Phot. A. Heilprin.

FIG. 5.—AÏ, OR THREE-TOED SLOTH, CLIMBING A LARGE FORESTER.

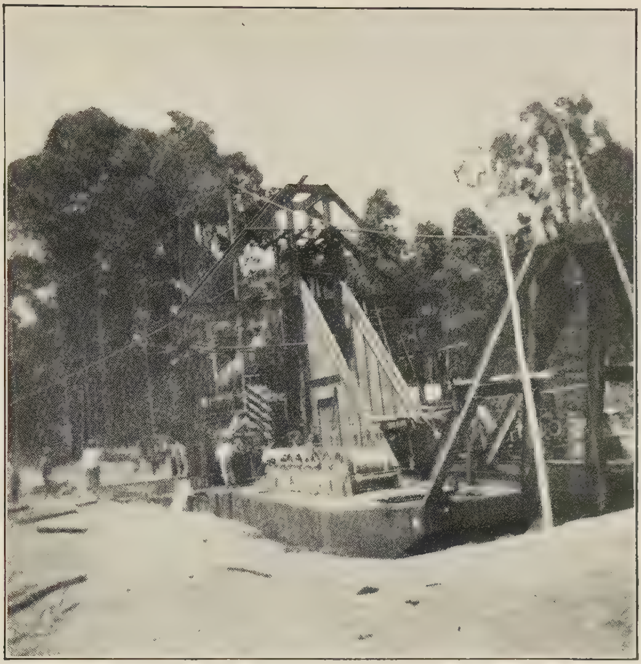
fright to a few negroes did no damage. The stock had been well guarded. My limited days in the woods did not permit me to become acquainted with more than a few of the animal forms that are represented to be most common in the region about. One of these was an individual of the three-toed sloth or aï (*Bradypus tridactylus*), which had wandered too close to a camp of dredge-builders, and was captured. It was most interesting to watch the antics of this animal. With a face more suggestive of an idiot than of anything else, and the bristling, shaggy coat wrapped about its awkwardly-moving limbs, it presented an aspect so singularly at variance with that of other mammals that one may easily pardon Waterton for having placed the figure of one on his frontispiece bearing the legend "A Nondescript." The animal made various efforts to secure his liberty by climbing up posts and tree-trunks, but he was taken away to be cared for in a neighbouring shack. His attempt to grapple a tree-trunk the dimensions of which were much too large for his enveloping arms was ludicrous in the extreme. As in other parts of the South American wilds, the leaves of the trumpet-tree or Cecropia constitute the sloth's principal food.

While the great forests of the North are largely deficient in bird-song, so much so that bird-life might be almost thought to be absent from them, this is in no wise true of the Guiana forest. The garrulous notes of the parrots and parroquets, the yelping calls of the toucan and aracari, sound from a far way in the lofty tree-tops, so far removed that one fails to recognize the brilliant colours with which these birds are adorned. Of exquisite tone are the resonant notes of the pee-pī-yó (*Lathria cineracea*), one of the numerous family of chatterers (*Ampelidae*). I do not recall a bird-note in any way comparable to that of this remarkable songster. Others are more musical, softer in cadence and melody, more brilliant in scale; but none has that emphasis of sound-volume, that metallic "parting of the ways," which distinguishes the pee-pī-yó. It is the most general note of the forest, just as the "*Qu'-est-ce-que-dit?*" is the dominant note of the gardens and streets of the city. I was not fortunate enough to catch up the bell-notes of the white araponga or bell-bird (*Chasmorhynchus carunculatus* or *niveus*), which is said to be a common form in these wilds.

Somewhat toward the evening hour, but at times heard throughout the day, the extraordinary, metallic whirr of the six-o'clock-bee or razor-grinder cannot escape one. The insect flits from bush to bush and seemingly a machine-shop goes along.

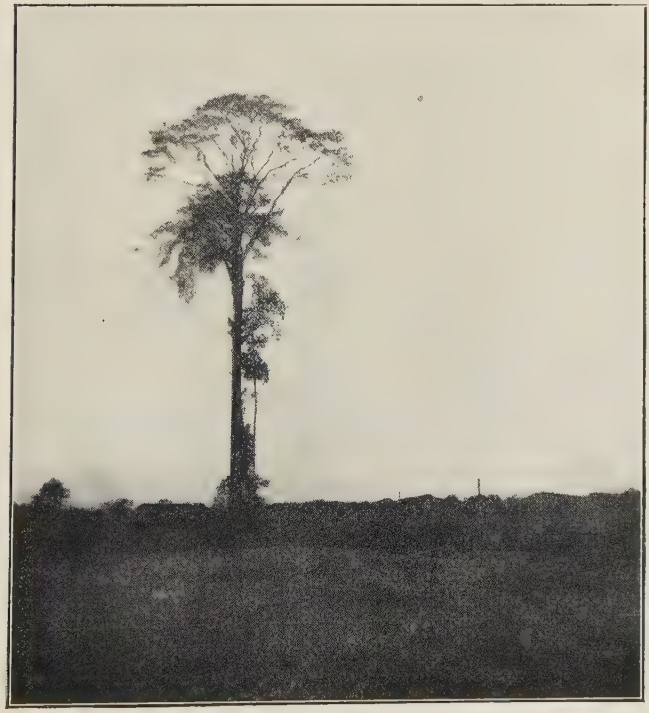
It is a noteworthy fact that the insect pests are not noticeably numerous in these forests—at least, they were not so in the parts that I visited. Recalling the account given by Humboldt of the torments that were inflicted by the myriads of mosquitoes along the Cassiquiare River, one could well be pardoned for fully preparing against like torments in the valleys of the Guiana rivers. But the mosquito was found to be almost wholly absent from both the Demerara and Essequibo rivers, and the minor insect plagues were about equally deficient, or, at least, not active. Presumably the large volume of swiftly-flowing waters was not favourable to the development of these plague-breeders, and the traveller was given to enjoy the beauties of Nature unmolested and unsought for blood-tribute. Even the great wasp or marabunta, whose home is more in the city than in the forest, gave no opportunity for complaint.

One of the most interesting facts connected with animal life that was called to my attention concerned a small bat, probably the *Desmodus rufus*, whose blood-sucking habits made caution necessary to both man and beast. I first came across this bat, which barely exceeded in size our own common *Vesperugo,* in the Demerara Exploration Company's clearing, about two miles from Omai Landing, on the Essequibo River. It was there a nightly and almost constant visitor to the mule paddock, and, when the opportunity permitted, it did not hesitate to attack the withers of the animals kept there, and draw their blood freely. So persistent were these attacks that it was found necessary, as a preventive to them, to have the paddock illumined throughout the night with electric lights, the bright glare from which was seemingly taken unkindly by the little vampires. The quantity of blood actually drained by the bats themselves is small, but when the work of bleeding has been finished there is a free flow, the nature of the wound being such as to remain open for a long time. It seems to be a fact that the animals attacked are not for a long time made conscious of the assault, but in how far this unconsciousness is due to a pleasant, cooling sensation which it is thought the bat imparts to his victim through the movement of his membranes I am unable to say. Chickens and fowl of all kinds are liable to attacks similar to those which involve the larger stock, and man himself is by no means spared. A coloured boy who was working in the Omai clearing had been bitten in the large toe of one of his feet two or three days before my arrival, and he was still limping when I made an examination of his foot. He only knew of the incident on awaken-



Phot. A. Heilprin.

FIG. 6.—ERECTING A GOLD-DREDGE NEAR OMAI LANDING.



Phot. A. Heilprin.

FIG. 7.—A FOREST EXILE (PURPLEHEART).—185 FEET IN HEIGHT.

ing from sleep and discovering a big clot of blood in the hammock which he occupied.

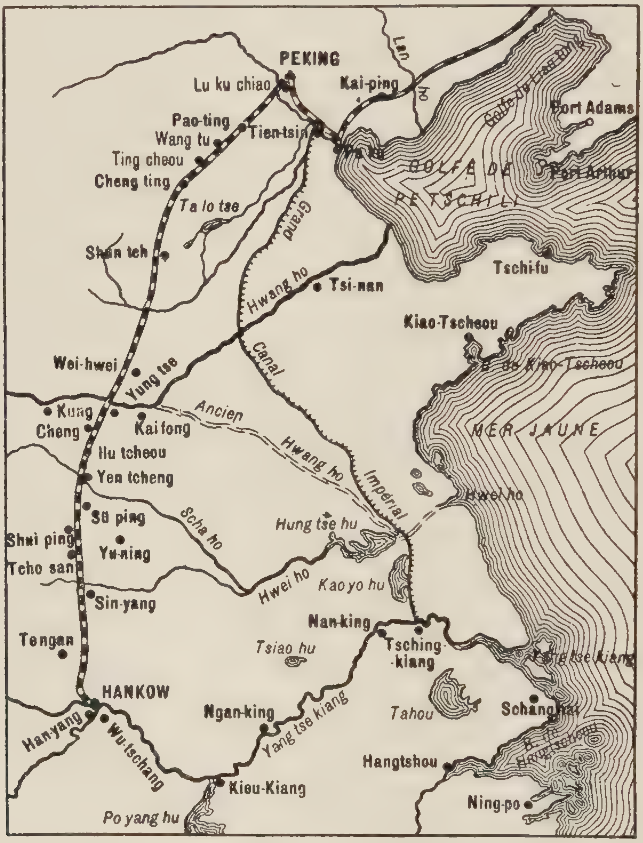
THE EXPLOITATION OF THE INTERIOR.

With no interior roadways, its vast and virtually trackless forests, and the obstructing rapids that break the navigation of its waters, it is in the colony not considered a matter for surprise that it should be slow to open up its resources to the world, or that the inhabitants should barely know what these resources are. The almost boundless resource of timber, in both hard and dye woods, has thus far hardly been touched for export. Lumber concessions, under a wise forestry supervision, there are here and there, but little of the material felled finds its way beyond the limits of the colony. The most important specific grants are for *balata,* or rubber, forests of which extend across from the Barima to the Mazaruni; but little has been realized thus far from the grants. In its mineral aspects the colony shows a somewhat better record, but yet far from one that need offer a type to other countries. Ever since the days when Raleigh set out in search of the fabled El Dorado the quest for gold has been an occupation in Guiana, and what little this quest has yielded has been more than sufficient to demonstrate that gold mining may before a distant future become an important industry. Nearly all the gold is obtained from placer deposits, gravels, and clays, or from a complex rock of a granitic or diabasic character which liberates its product on decomposition. Until recently the work of mining was conducted on a rudimentary or losing system, but latterly considerable profits have been taken out from a few of the holdings where modern machinery has been introduced. Large pumping-engines, dredges, and stamps have already found their way into a few spots in the interior, and before long, doubtless, other locations will be similarly provided. Diamonds of an unusually clear water have been obtained from a few localities, but as yet little is known regarding their occurrence. Other valuable minerals, except the commoner kinds, have not heretofore been discovered. It is, however, only the exploration of the future which can give to us their full value.

Highways can and will be built into the interior, the rivers will be opened fully for navigation, and then the naturalist's paradise will gradually be converted into the prosaic commercial *Hinterland.* Until that time we may continue to wonder how it came to pass that a region so easily accessible, so prodigal in the fruits of Nature, should have so largely escaped the attention of the working naturalist.

THE PEKING-HANKOW RAILWAY.

Mr. Jean Jadot, who had charge of the construction of the Peking-Hankow Railway, which is now being extended by the Chinese Government to Canton, has recently returned to Brussels. *Le Mouvement Géographique* (No. 28, 1906) describes the farewell honours paid by Chinese officials to Mr. Jadot on his departure, and prints a concise record of the enterprise, which is interesting as a part of the history of what will probably be the first great trunk line through China. The facts given here are from this article, and the map that accompanies it is also reproduced.



The line from Peking to Hankow is 753 miles long between the terminal points, with short branches to mines, adding about sixty miles to the length of the track. It traverses, from north to south, the provinces of Pechili, Honan, and Hupé, which are among the most populous of China. The construction of the road was begun at both ends of the line at the end of 1898 and the opening of 1899. The northern section of the work had been extended for a distance of 114 miles south of Peking when it was interrupted in May, 1900, by the Boxer revolt. A large part of the completed portion of the railway was destroyed, a considerable number of the employees were killed, and the final completion of the road was undoubtedly set back at least a year by the insurrection.

Early in 1901 order was sufficiently restored, through the military occupation of Peking by the Powers, to warrant the resumption of work. There was no further interruption of the enterprise, and it was steadily—though, according to Western ideas, not very rapidly—pushed until its completion towards the end of 1905. It was officially opened on November 12 of that year.

A little more than half of the road was built by the northern working force, which met the southern party a little to the south of the Hoang River.

The railway was built by the "Société d'étude de chemins de fer en Chine," composed of a group of French and Belgian banks and some of the leading construction companies of the two countries. This company carried out the work under a revised concession granted by the Chinese Government in June, 1898, under which the capital of the company, $250,000, was augmented by the floating of bonds to the amount of $22,500,000, guaranteed by the Chinese Government and by the earnings of the railroad, the debt to be paid in twenty years after 1909.

Most of the material, fixed and rolling, was imported from Belgium and France. China having little timber, even the railway ties were imported, 130,000 of them coming from France, 50,000 from the Baltic countries, a small quantity from Oregon, and the remainder from Japan. The steel works of Hanyang, near Hankow, supplied about 75,000 tons of rails. A supplementary issue of bonds to the amount of $2,500,000, under the same conditions as the first loan, was floated in 1905 to meet the final expenses of the construction and rolling stock.

At the close of last year there were in the service 101 locomotives, 145 passenger cars (first, second, and third class), and 2,200 freight cars of from 15 to 40 tons capacity. The foreign builders of the road have formed a mining company under the name of "Mines du Luhan," which holds the concession for the development of several coal fields that will supply the railroad with an excellent quality of fuel.

Although the line extends in part through a very hilly and even mountainous country, there are only two short tunnels, both of them piercing the hills immediately to the south of the Hoang River. There are, however, about 100 steel bridges from 650 to 2,200 feet in length, besides the great bridge over the Hoang River, which is wholly constructed of metal, is nearly 9,900 feet long, and is one of the great bridges of the world.

The abstract of statistics in the Chinese "Returns of Trade" for 1905 says that the work on the prolongation of this railway from Hankow to Canton was deferred until it should be settled who was to construct it and with what funds, but was resumed in March, 1906, under Chinese auspices and with Chinese capital.

GEOGRAPHICAL RECORD.

AFRICA.

The Duke of the Abruzzi's Ascents in the Ruwenzori Range.—The newspaper press announced some time ago that the Duke of the Abruzzi, whose expedition to Mount Ruwenzori sailed from Naples on April 17, had climbed the highest summit in the range, the height of which, however, was not given. A few additional particulars since received show that at last accounts his work was progressing very favourably. On June 18, only two months and a day after his departure from Naples, he had already ascended the highest point of the range, which he found to be 5,800 meters, or 19,024 feet, above sea-level, so that it is probably the second highest summit in Africa, the Kibo peak of Kilimanjaro, with 19,712 feet, being the culminating point of the continent, and Kenia, with 18,105 feet, occupying the third place.

Petermanns Mitteilungen (No. 7, 1906) says the expedition proves how much good work may be done in a short time by a party into whose organization and equipment the question of cost has not entered. Everything that might contribute to the success of the expedition was supplied without stint. The Duke of the Abruzzi is accompanied by Captain Cagni for magnetic and meteorological observations, Dr. Cavalli for geology and botany, Professor Roccati for mineralogy and geology, Vittorio Sella for photography, and Lieut. Winspeare for topographic surveying. In addition to this scientific staff, five experienced mountain guides were taken and 450 native carriers were secured at Entebbe, on the north coast of Victoria Nyanza, to transport the supplies to the foot of the glacier on the eastern slope of Ruwenzori, where the base camp was pitched. Before he climbed the highest peak of the range the Duke ascended a number of the lesser summits. He hoped to complete a good topographical survey of this entire mountain mass before returning home.

SNOW IN THE SAHARA.—The *Bulletin* of the Comité de l'Afrique française reports in its numbers for March and May that last winter was very severe in the Sahara. The courier service was interrupted for many days after Feb. 8 on account of bad weather. Snow fell on Feb. 10 to the south and southwest of Wargla, and on Feb. 5 it snowed at El Golea from 6 A.M. to 3 P.M., and, on the sixth, all day with few interruptions. The depth of the snowfall was four to five centimeters (nearly 2 in.). The northern limit of this snowstorm was El Khoua, and it extended through the region occupied by Fort MacMahon to the Gurara group of oases, its southern limit being near Uakda. On the morning of February 6, the region around Timmimun was covered with three to four centimeters of snow. The oldest inhabitants of El Golea say they never knew snow to fall there before.

BOERS SETTLING IN THE KILIMANJARO-MERU DISTRICT.—The immigration of Boer farmers into this northern part of German East Africa is increasing. The Government requires that each family permitted to take up land must have a capital of about $2,000, so that the pioneers may begin life in this new region under fairly satisfactory conditions. The immigrants also agree that in case of native uprisings they will assist the Government to restore peace.

In January last 397 immigrants were settled on 126 farms, in the district Iraku, around Mount Meru. Southeast of Arusha, on the slope of Kilimanjaro, another settlement of 300 families is in progress. The Government, believing it is best to assure mixed settlements, reserves areas between the Boer farms, on which German farmers will be established. This policy is especially desirable because most of the Boers are chiefly cattle-raisers, while the Germans are agriculturists, and the mixture of the two elements, it is believed, will give rise to considerable industrial development.

The rapidity with which this elevated and healthful region is filling up with white settlers makes it necessary to hasten the completion of the railroad from Tanga to the neighbourhood of Mount Meru. At present the colonists are using the Uganda railroad in the British East Africa Protectorate, which largely diminishes the length of the land haul. The British hope to keep a part of this transportation trade by building a branch road from Voi station to the German boundary at Kilimanjaro.

THE SEBU RIVER, MOROCCO.—A French expedition in charge of Dr. Samné is reported by the *Annales de Géographie* (No. 81, p. 280) to have made a careful study last year of the navigability of the Sebu River in Morocco. The results were most satisfactory, for the party ascertained that flat-bottom boats will be able to ascend the Sebu for about 130 miles from its estuary, and even at the low-water stage light draft boats will be able to ascend to the neighbourhood of Fez. It is certain that this waterway, which fertilizes the lowest plain in Morocco, offers an excellent route to the interior, and that a number of towns might flourish on its banks. Dr. Samné calls attention to the opportunity to revive the port of Mehdiya, on the left bank of the estuary, which was a prosperous town from the time of the Phœnicians to the heyday of the Portuguese navigators in the sixteenth century. To-day it is merely a small village, three-fourths in ruins, and occupying the centre of a region hostile to Europeans. There is a bar at the mouth of the Sebu; but it is not an insurmountable obstacle, and it may be removed without great expense.

THE EXPEDITION OF LEO FROBENIUS IN THE KASSAI BASIN.—This ethnologist, whose researches have contributed some new ideas as to the origin of African civilizations, has recently been exploring the region of the Kassai, the second largest tributary of the Congo. The results, which he communicated by letter to the Berlin Geographical Society, are summarized in the *Annales de Géographie* (No. 81, p. 284). He was preceded in this region by the German travellers Wissmann, Wolf, Pogge, Kund, and Tappenbeck, but his work renews our knowledge of the tribes in this part of Africa, and he has also completed surveys of the hydrography, where the South African plateau meets the plain of the Congo.

Accompanied by the artist, Hans Martin Lemme, Mr. Frobenius started from Dima, a large trading-point on the Kassai, a little above the confluence of the Kuango, and first studied the tribes of the Kuilu, as far as the falls above Kiknitt. In this region he discovered an entirely unknown river, the Kantcha. Then, returning to the middle Kassai, he methodically studied the region of the great river to above Pogge Falls, and also the lower Lulua, making more or less extended sojourns at Mange, Bena Makima, Mai Munene, Chikassa, and finally reached Luluaburg. He intended to complete his journey by studies along the Lulua and Sankuru rivers.

On the Kassai he surveyed two unknown sections of the river between Pogge and Wissmann Falls. He discovered a new waterfall, much finer than Wissmann Fall. The new fall was named after his companion, Lemme Falls. Under this parallel (approximately 6° S.) the rivers have their "fall line" not less clearly marked than that bordering our Atlantic coastal plain. This fall line marks, in a striking manner, an ethnographical and geographical boundary.

To the north is the forest with scattering trees at first, soon succeeded by dense growths. Here are settled civilizations relatively old, with traces of aboriginal tribes, or, in other words, the oldest that have been found here. These tribes are the Bayansi and the Babunda. To the south large affluents course over the plateau and savanna regions, which conduce to movements of the population. From these southern plateaux numerous invasions of the more northern country have occurred, such as those of the Baluba and Babunda tribes, that founded the great empire of the Muata Yamvo, of which Livingstone told us and which Pogge described. This empire no longer exists, for it was wiped out about twenty years ago by a new tribe, the Kioko. The Bachilangue of Pogge and Wissmann are to-day dispersed, and the Kioko have invaded the low country to the north. Thus the old theory of the advance of African peoples by successive waves coming from the north and east is here contradicted by the facts.

Mr. Frobenius draws attention to the rapid destruction of the cascades by water agency. Everywhere the sandstone faces of the falls are retreating. The appearance of Wissmann Falls, for example, has entirely changed since 1886. A large new section has also formed in Pogge Falls. Mr. Frobenius considers his discoveries as to the origin of Bakuba art and the poetical folklore of the Baluba as of special importance. His work thus far is described in greater detail in the *Zeitschrift* of the Berlin Geographical Society (1905, pp. 467-471; 1906, pp. 114-118 and 426-431).

THE FUTURE OF KATANGA.—Mr. H. Buttgenbach, a mining engineer, who spent two years (1902-1904) in Katanga, the southeast province of the Congo

Free State, has returned to Europe fully convinced that the resources of this region exceed those of any other part of Central Africa. He asserts (*Bulletin* de la Soc. Belge d'Études Coloniales, No. 6, 1906) that European colonization is warranted by the climate of this high plateau. Agriculture may have enormous development on these wide, alluvial plains. Many waterfalls will afford vast water power. The wealth in copper and gold may almost be considered inexhaustible. These prime advantages are certain to make Katanga the country of the future in Central Africa. He believes Katanga to be the richest copper region in the world. Every month new discoveries are being made. Over 120 ore beds have thus far been located, and thirty of them are believed to contain at least 15,000,000 tons of copper at levels not deeper than 130 feet. At the present rate of consumption the copper in these thirty deposits would supply the world for twenty years. Large deposits of tin are found near the navigable reaches of the Lualaba, and the gold discoveries are most encouraging.

NEW AGREEMENT BETWEEN GREAT BRITAIN AND THE CONGO FREE STATE.—The agreement of 1894 between these countries relating to what is known as the Lado Enclave was replaced on May 9 by a new agreement signed at London. King Leopold during his reign will continue to occupy the territory, which shall, however, be handed over to the Sudanese Government within six months of the termination of His Majesty's occupation. The Free State will not permit the construction of any work on or near the Semliki River which might diminish the volume of water entering Lake Albert. A concession will be given to an Anglo-Belgian company for the construction and working of a railway from the frontier of the Free State to the navigable channel of the Nile near Lado. This railway shall be wholly subject to the jurisdiction of the Sudanese Government after the end of King Leopold's reign. The Egyptian Government will guarantee interest of three per cent. on $40,000,000 required to build the railway. A port open to general commerce shall be established at the Nile terminus of the road. Congolese vessels shall have the right of navigating and trading on the upper Nile, subject to Sudanese laws and regulations.

AGRICULTURE IN FRENCH WEST AFRICA.—Mr. Auguste Chevalier, whose remarkable explorations in the Chad basin are well known, returned to French West Africa last year to find the best place for establishing a large botanical and agricultural station, to inspect somewhat similar establishments already existing, and to study the present trend of tropical agricultural development. This official mission occupied him for nine months. His report is not yet ready for publication, but he has printed some of his conclusions concerning the present agricultural situation in the *Renseignements coloniaux et Documents, Comité de l'Afrique fr.* (XV, Dec. 1905, pp. 485-491). Native agriculture on the Guinea coast, he says, has a hopeful future. The cultivation of the groundnut in Senegal is already a success and the increasing oil industry in Togo, Dahomey, and the Cameroons shows that the black population on this coast can be induced to work.

The great results already attained in the cultivation of cacao at St. Thomas and on the Gold Coast justify the conclusion that this industry will have enormous growth in West Africa. Fifty years ago the cacao tree was almost unknown in Africa. Its cultivation was begun at St. Thomas about 1850. At present St. Thomas and Principe islands are producing over 50,000,000 pounds a year, valued at more than $6,000,000. The Portuguese are very proud of this brilliant history and call it the greatest material success yet realized in West Africa. It is possible that the British Gold Coast, however, will surpass the Portuguese islands. The Gold Coast is now exporting cacao, though not a cacao tree was to be found there in 1885. To-day the region is producing about 11,500,000 pounds a year, worth about $1,000,000. All the work on these Gold Coast plantations is done by natives, and they own the plantations. There is not a single European plantation devoted to this crop.

COTTON IN GERMAN AFRICA.—The Kolonial-Wirtschaftliches Komitee has issued its seventh report on the German cotton experiments in the colonies (*Der Tropenpflanzer,* No. 6, 1906), in which it says that, although the Togo cotton crop in 1905 suffered from unusual drought, 257,500 pounds, valued at 150,000 marks, were exported. Colonial cotton can never compete in the world's markets with the present sources of supply until the hoe culture of the natives is replaced by the plough. Experiments thus far in Togo and other German colonies show that the natives under European tuition learn quickly how to handle the plough and to drive draft animals. Both horses and oxen have demonstrated their usefulness in Togo. In East Africa the harvest was delayed and the crop impaired by the native uprising, though 650 bales of 500 pounds each, worth over 200,000 marks, were finally obtained. Cattle disease has thus far prevented the successful introduction of the plough into this colony. The prospects in the Cameroons are encouraging in certain districts, and also in the northern part of German Southwest Africa. The transportation problem, however, is a serious one in all the colonies. Cotton cannot pay high freight rates, and until railroads are developed there can be no large expansion of colonial cotton-growing.

AMERICA.

MINERAL PRODUCTIONS OF NEW YORK IN 1905.—The New York State Museum gives in *Bulletin* 102 a report on "The Mining and Quarry Industry of New York State" in 1905. The mineral resources of this State are the basis of rapidly-growing industries. About thirty materials are now commercially exploited, and the aggregate value of the output last year was $34,663,553. Nearly one-third in value of the whole production is building brick, which were produced last year to the amount of $10,054,597, of which about four-fifths came from the Hudson River region. The limestone, quarried both for building stone and for making Portland and natural cements, was worth $2,411,456. The iron ore product was 827,049 long tons, worth $2,192,689, the progress of this industry being one of the most notable features of the year; 8,575,649 barrels of rock and brine salt, worth $2,303,067, were produced, a considerable part of the salt being used for the manufacture of soda products. The combined value of the petroleum and natural gas was $2,173,931. The other largest products were sandstone, mineral waters, pottery, Portland cement ($2,046,864), and natural rock cement ($1,590,689).

PROFESSOR HEILPRIN AT MONT PELÉ.—Professor Angelo Heilprin, who visited Martinique in February, writes in *Science* (No. 601) that the Pelé obelisk now exists only in its basal wreck, in the jagged crest which still protrudes from the summit of the supporting dome, and in a wilderness of débris composed of small and giant fragments. All doubts as to the character of the rock mass which built up the monolith may probably now be considered removed. The rock is a compact light gray and virtually holocrystalline hypersthene-andesite, devoid of vesicles or of any vesicular or obsidian-like structure, and having a fine-grained base. Professor Heilprin sees no reason to change his view that the monolith represented an ancient plug or core that had been lifted up in the manner of the giant granite mass of the Puy Chopine, of the Auvergne. Pelé was not in activity in the early part of this year and, to all appearances, had no participation in the events associated with the earthquakes in St. Lucia and Martinique on Feb. 16. The dome in its upper parts is still quietly disengaging vapour.

A GAZETTEER OF COLORADO.—This is the sixteenth of Mr. Gannett's useful gazetteers of the States and Territories. It contains 185 pp. and is *Bulletin* 291 of the U. S. Geological Survey publications. The Hayden Survey published a topographical and geological atlas of the State which, in later years, had potent influence in its development. The total area mapped by the present Survey is about 38,000 square miles, or considerably more than one-third of the State.

THE SALTON SINK.—The U. S. Geological Survey has issued a topographical map of the parts of California and Mexico occupied by the great depression in the Colorado Desert known as the Salton Sink. The map is called the Salton Sink Special, and it shows on a scale of about 8 miles to an inch all the principal towns, roads, canals, and drainage lines. This region has been considerably discussed in the newspapers recently, owing to the threatened formation of a large lake where there is now a thriving community.

About 8,000 people settled in that part of the basin known as the Imperial Valley are raising excellent crops of barley and alfalfa. Stock farms are numerous, and experiments in raising the date-palm are in progress. The freight shipments from Imperial, a town only four years old, rival those of Los Angeles in value, and are said to exceed those of any other town in Southern California.

The existence of this community is, however, seriously endangered by the Colorado River, which is also the source of all its prosperity, as this stream furnishes water for the irrigation system. The absence of any controlling work at the head of the main canal has resulted in diverting the river from its old channel and permitting the entire flood-flow to enter the irrigating system. This is causing great damage to the ditches and crops, and is forming a large lake, which now covers about 250 square miles, at the lowest part of the Sink. The Southern Pacific Railroad has been obliged to rebuild many miles of tracks.

A NEW MAP OF GUATEMALA.—Mr. H. Prowe writes to *Globus* (No. 19, Vol. 89) from Guatemala that the civil engineer Claudio Urrutia has made a new map of that country on a scale of 1:100,000, or 1.5 statute miles to an inch, which, though the triangulation of the republic is not yet achieved, is based in most respects upon scientifically-ascertained data. A number of the maps used in the compilation, for example, were based upon astronomically-fixed positions, the boundaries upon boundary surveys, and the compiler was also assisted by Carl Sapper's surveys in the interior of the country, the studies by American engineers for the inter-continental railroad, the hydrographic coast charts, etc. Urrutia's special contribution is his delineation of the roads, his city plans, and the boundaries of the landed estates as on a cadastral map. With the assistance of Francisco Vela he has also inserted about 1,000 contours of elevation. The map, which has been prepared with the support of the Government, is to be reduced to a scale of 1:300,000 and published.

RAILWAYS IN COLOMBIA.—The plan for the reorganization of Colombia, devised by General Reyes, is now being carried out. It includes large railway development, and the money to build some of the railways is already assured by foreign companies which have large investments in the republic. The concessions recently granted will tend ultimately to place the capital Bogotá in rail communication with both oceans. The lines already contracted for to the west of Bogotá represent about one-fourth of the distance between the capital and the Pacific port of Buenaventura. A number of links in the line to the Atlantic are also under contract.—(Condensed from the *Bulletin* of the Inter. Bureau of the American Republics, June, 1906.)

MUSEO DE LA PLATA.—Samuel A. Lafone Quevedo has been appointed Director of this Museum to fill the vacancy caused by the retirement of Dr. F. P. Moreno. By a law recently passed the Museum has been made a Faculty of Natural Science as a constituent part of the National University of La Plata, lately created. The different sections have been grouped in schools as follows: 1°, Geological; 2°, Biological; 3°, Anthropological; 4°, Geographical; 5°, Chemical.

PROFILE ACROSS SOUTH AMERICA.—The *Boletin* of the Lima Geographical Society (Vol. 15, No. 3) prints a large section across South America from Mollendo, Peru, to Pará, on the Atlantic side. The vertical scale is largely exaggerated to emphasize the irregularities of form in the section across the Andes. The horizontal scale across the Cordilleras is also exaggerated to give room for the names of heights and depressions among the mountains. The water-parting between the Atlantic and Pacific along this section is at Aguas Calientes, 3,975 meters (13,000 feet) above sea-level and 640 kilometers (400 miles) from the Pacific.

EXECUTIVE ORDER.—The official title of the United States Board on Geographic Names is changed to "United States Geographic Board." In addition to its present duties, advisory powers are hereby granted to this Board concerning the preparation of maps compiled, or to be compiled, in the various bureaus and offices of the Government, with a special view to the avoidance of unnecessary duplications of work; and for the unification and improvement of the scales of maps, of the symbols and conventions used upon them, and of the methods of representing relief. Hereafter all such projects as are of importance shall be submitted to this Board for advice before being undertaken.

THEODORE ROOSEVELT.

The White House, August 10, 1906.

ASIA.

THE REFORM MOVEMENT IN CHINA.—Periodicals dealing with Chinese affairs are constantly publishing evidence of the progress of the reform movement. Here are a few facts taken from a recent Consular Report and from the *Mitteilungen* of the East Swiss Geog. Comm. Soc. (No. 2, 1905):

U. S. Consul Anderson writes from Amoy that the authority to confer degrees upon scholars has now been vested in the University at Peking and in the colleges which the Government will establish in each province. The Government in 1903 appointed a Commission of three high officials to study the whole question of education. The result of its report is that a Board of Education has been established in Peking to decide upon methods of introducing Western education and a school system of different grades. The old literary examinations have been abolished by Imperial edict.

A Commission of high officials has been sent to Europe to study the workings of constitutional government. The practice of foot-binding has been forbidden in a number of the provinces. The Chinese press is spreading new and modern ideas among the people. A daily paper has been started in Peking with the title "Women's Newspaper," which is already widely distributed. Progress and reform are the burden of every page. Here are the titles of some of the articles that appeared in this journal within a few days: "The Absurdity of Fortune Telling," "Torture to Extort Confessions must be Abolished," "Proof that the World is Round and that it Moves," "Care of Children," "Kind Treatment of Animals," "Evils of Opium Smoking," "Appeal for the Formation of an Anti-Opium League," "Love of the Fatherland." Only a few years ago the official Peking *Gazette* was the only newspaper in Chinese, but to-day newspapers for the common people are multiplying, and they bring all kinds of questions to public attention. About 3,000 miles of railroads are now in operation, and concessions have been granted for the building of some thousands of miles more.

THE BARRETT EXPEDITION TO CENTRAL ASIA.—Mr. Ellsworth Huntington returned home in May from Chinese Turkestan. Information about the earlier part of the work of Mr. L. R. Barrett and Mr. Huntington has already appeared in the BULLETIN (1906, p. 236). Mr. Huntington was a member of Mr. Barrett's expedition until September, 1905, after which he worked independently. He is now engaged in writing an account of Central Asian geography and experiences. His work concluded with an examination of the Lop Nor region. His party travelled for four days on approaching this lake over a great salt plain covered with hard deposits of salt. It is evidently the site of an old lake-bed. A journey was then made over an older lake floor, red in colour, and glistening with crystals of gypsum. The whole country was absolutely desert, and was exceedingly cold, the temperature dropping at night several degrees below zero, Fahrenheit, more than forty degrees of frost being registered. From Lop Nor the party proceeded by a new route across the Kuruk Tagh Mountains to Karashar, from which place a visit was made to the Turfan depression.

TOPOGRAPHICAL MAP OF NEPAL.—The Survey of India Report for 1903-4, which has just been issued, contains the only topographical map of Nepal yet published. It shows the conformation of the mountains in a wide section of the Himalayan system. The *Geographical Journal* (Aug., 1906) says that this map is the work of Captain Wood, who was the first English surveyor permitted to take observations in Nepal. The map sets at rest the disputes which have arisen about the position of Mount Everest, proving the peak to be far removed from others which have been confounded with it and placing them all in their true relative positions. It also indicates that the great snowy range of the Central Himalaya (sometimes mistakenly called the Indian watershed) possesses no continuity through the width of Nepal from west to east. The group of mountains of which Everest forms the centre and the contiguous group dominated by the peak known as Gaurisankar, at any rate, form no part of it. The position of certain passes leading into Tibet north of Katmandu may now be located with a fair approximation to exactness. It is probable that Mount Everest is higher by 140 feet than the height (29,000 feet) at present assigned to it, and that we shall eventually find that Kanchinjanga and not K 2 (Godwin Austen) holds the second place.

TIBETAN CARPETS.—The *Indian Trade Journal,* quoting from Mr. P. Landon, says that at Little Gobshi there is the finest rug factory in Tibet. Mr. Landon found a large two-story house, with a courtyard, entirely filled with the looms of men and women workers. The patterns used are native Tibetan, and the colours are excellently blended and rich in themselves. It is difficult for Tibetan weavers to make a piece of stuff wider than about thirty inches, because their looms are of a primitive description; nor do they attempt to make a pattern larger than can be contained upon a single width. The plain orange and maroon rugs are made in narrow strips and sewn together to any desired width, but this is not done with the figured cloths. When the eye is once taught to recognise the difference the cheaper rugs (worth about 3 rupees) are easily seen to be inferior from every point of view to those which the makers will not sell for less than 25 rupees. The entire annual output of this Tibetan factory is about 500 rugs.

SURVEYS AND MAPS OF THE PHILIPPINES.—Mr. H. D. McCaskey, chief of the Philippine Mining Bureau, in his Report for the year ending Aug. 31, 1905, says that the present maps of the Phillippines are very inadequate. Development is embarrassed by the almost total lack of topographic data for railway, high-road, and other surveys. There are no topographic maps on which to base mineral, forestry, agricultural, and other industrial surveys of importance. At present, special topographic surveys must be made for each project carried out upon scales suited to the special work involved, and therefore not necessarily in harmony with other scales used. This work is not a total loss, but it is not in accordance with the highest cartographic or economic demands. It is a more serious matter that no primary triangulation of the islands has been made from which a skeleton frame may be constructed upon which secondary or tertiary triangulation maps and accompanying topographic data may be fitted as fast as secured. The great need is a primary geodetic triangulation, which must be made sooner or later, as a fixed basis for all future Philippine survey work. It could be made under the direction of the Bureau of the Coast and Geodetic Survey as a proper extension inland of its excellent astronomic work. The public land surveys, including surveys of mining claims, are in actual need of triangulated base maps, and without them serious trouble concerning boundaries will arise. Surveys are now being made to fill present needs by the military and civil governments over limited areas.

DIFFICULTIES OF GEOLOGICAL EXPLORATION IN THE PHILIPPINES.—The Report of the Philippine Commission for 1905 mentions some of the difficulties that have combined to check mineral exploration and development in the islands. Geological exploration and field prospecting are hindered by the obstacles imposed by the luxuriant forest and jungle growths and the excessive thickness of soil overlying rock formations. The number of intelligent prospectors and miners is still small, the United States are at a great distance, and it is consequently difficult to secure capital, and the somewhat uncertain future of the islands also tends to cripple enterprise. The result is that large portions of the islands have not been explored by prospectors even to the present day.

GROWTH OF INDUSTRIES IN JAPANESE VILLAGES.—The *Transactions* of the Asiatic Society of Japan (Vol. 32, Part 2) says that a very notable change has come over many Japanese villages, owing to the immense increase of industries established throughout the country since the close of the war with China. This is not only the case in districts where the production and manufacture of silk have always been important. In purely agricultural districts—in Saitama Ken, for example—cotton-spinning and weaving industries have been largely developed. All over this district are small factories employing from fifteen to twenty hands at spinning or weaving coarse cotton cloth. Most of the workpeople are women.

MR. GEIL'S NEXT JOURNEY.—Mr. William E. Geil, who has recently returned from a five years' journey around the world, studying native races and observing missionary operations, will sail from the Pacific coast in December for the purpose of following the Great Wall of China to the Province of Kansu, whence he will take a northerly course across the desert of Gobi, a part of his route being over unexplored ground. In China, he will keep to the south of the Wall. He will make an instrumental survey of his route through the desert, whence he will probably go north to Siberia. He is already experienced in Chinese travel, and his last journey there was from Shanghai up the Yangtse to Yunnan-fu and Bhamo in Burma.

EUROPE.

GEOGRAPHY AT GÖTTINGEN UNIVERSITY.—It will interest many teachers of geography to read the following extract from a letter written to a friend in this city by a young American who began, with the summer semester, the geographical course at Göttingen under Professor Wagner. The student is taking all the geography given in this semester, which includes mathematical geography four hours a week; the cartographical course, Part 2 (map interpretation), 2 hours a week; geographical exercises, three times a week; geographical colloquium, with papers by the various participants and discussion, three times a week; and geography of the Mediterranean countries, twice a week. Professor Wagner conducts the entire programme excepting the lectures on Mediterranean countries, which are by Dr. Friederichsen. The writer says:

> All of the courses are full to overflowing. Professor Wagner is very popular even with non-geographers. In the geographical exercises I received the problem of drawing the cross sections of the North American continent where it is traversed by the parallels of 30°, 35°, 40°, 45°, 50° N., or, in other words, 5 profiles to the scale of 1:10,000,000, the vertical scale being exaggerated 100 times. I finished four of the profiles and they show remarkably clearly the high altitudes west of 100° W. in contrast with the cis-Mississippian country. I am also to determine, with the planimeter, the area of these cross sections, then the length of the land portions of the parallels and finally the mean altitudes of the continent. This gives you an idea of the work I am doing. I find it very interesting. In the cartographical course, we are beginning with copying to the same scale as the original. In the exercises I had a paper to write on coral islands, this subject having been chosen for me on account of my knowledge of English in view of the English writings on the subject.

Cave Exploration.—The latest issue of *Spelunca* is a double number (Nos. 42 and 43), completing the review by Mr. E. A. Martel of the caves of the world, to which No. 1 of Vol. 6 of this publication was devoted (Bulletin, 1905, p. 671). The whole work is a summary of what has been done in cave exploration thus far in the twentieth century, the first part being reserved to the caves of France, while the concluding part deals with the caves of the rest of Europe, Africa, America, Asia, and Oceania. The whole will make a volume of 450 pp. The information is drawn from numerous sources, and the work is practically a complete bibliography and record of recent activity in this line of exploration. France has a far larger share (194 pp.) than any other country, 197 pp. being given to the rest of Europe, about 24 to Africa, 22 to America, 7 to Asia, and 5 to Australia and Oceania. Many items are merely bibliographical notices of papers that have appeared, usually in the scientific periodicals. A very large number of caves is mentioned, and the newly-discovered features are described. The results of Mr. Martel's laborious task cannot fail to be very helpful to students of this phase of physical geography.

Grottoes and caverns are used, more or less, as shelters by primitive peoples, and thus inhabited caves are, of course, most frequent in Africa. A considerable number of natives make their home in caves along the southern shore of the Strait of Gibraltar, and in some of these caves are found the polished stones and arrowheads of the Stone age. Troglodyte villages are frequent in the Tebessa territory of Algeria, one of which, at Djeurf, 250 feet above the gorge of the Wadi Hallail, is reached by steps cut in the rock. The inhabitants of the Tunisian Island of Galite are cave-dwellers, their habitations being grottoes which they have dug out of the limestone, or ancient burial caverns that they have enlarged. The subterranean villages of Matmata and of Medenine, hewn out of the rock, are in southern Tunisia. A Christian monastery, built under ground in the twelfth century, still exists at Goba, Abyssinia. The explorer Chevalier found many troglodytes to the north of Baguirmi. The enormous cavern discovered several years ago, within two hours' walk of the port of Tanga in German East Africa, contains rooms whose roofs are from 120 to 250 feet above the floor. Only a few of these vast chambers have yet been explored, for the entire cavern seems to be inhabited by millions of bats. One of these, killed with a stick, measured nearly five feet across its extended wings. The stories about the grottoes of Katanga, Congo Free State, which were said to have been dug by the natives as dwelling-places, are now declared to have no other foundation than the fact that the natives often retire to openings in the dolomitic rock which serve as places of refuge from their enemies. Many troglodytes are living in caverns in British East Africa to the north of Mount Kenia.

La Rivista Coloniale.—The Istituto Coloniale Italiano has issued the first number of a monthly with this title (May, 1906). It is a handsomely-printed magazine of 172 pp., and is the largest of the several colonial publications now appearing in Italy. The purpose of this new publication is to keep the public fully informed of colonial affairs, in the expectation that a study of colonial questions and the interests of the colonies will thus be stimulated, to the advantage of the colonies, of the motherland, and of Italian colonists who go to foreign countries. The first number contains papers on Italy since the conference at Algeciras, the organization of the agricultural-colonial service, the antiquities of Tripoli and

Cyrenaica, the colonial expansion of Italy, the United States and Italian emigration, the commerce of Eritrea and the Ethiopian markets, the finances of northern Italian Somaliland, colonial information, book reviews, etc.

INDEX TO THE GEOGRAPHICAL JOURNAL.—It will interest all geographers to know from the last annual address of the President of the Royal Geographical Society (*Geog. Jour.*, July, 1906) that a general index to the first twenty volumes of the *Geographical Journal* is about ready for publication. It will form a volume of about 600 pages in double columns. The notices of geographical literature and maps in the *Journal* are more complete than in any other publication except in the *Bibliotheca Geographica* of the Berlin Geographical Society, and the new index will be invaluable for purposes of reference to all workers in the subjects to which it relates. It is gratifying, also, to learn that the general index to the fourteen volumes of the earlier *Proceedings* of the Royal Geographical Society is also well advanced.

EROSION OF THE BRITISH COASTS.—A Royal Commission has been appointed to consider questions relating to the erosion of the British and Irish coasts. The Commission is to report as to the encroachments of the sea on various parts of the coasts, the damage which has been or is likely to be caused thereby, the measures that are desirable for the prevention of such damage, and whether further facilities are needed for the reclamation of tidal lands.

THE GERMAN STATISTICAL YEAR BOOK.—The twenty-seventh issue of the *Statistisches Jahrbuch für das Deutsche Reich*, published by the Imperial Statistical Office, is just received. As usual, this summary of about 400 pages is a fine example of classification, arrangement, and clearness. Statistics in these volumes are easy to find and inaccuracies rarely occur. For some statistical purposes the quarto volumes issued four times a year by the German Statistical Office are essential, but this annual summary, though lacking the details of the larger publication, is adequate for most purposes, and may be consulted more easily than the larger work. The issue for 1906 contains about fifty pages of comparative statistics of the world, the annual being a source to which writers on the comparative statistics of the nations often go for information. The comparative tables this year number 31, some of them covering a number of pages, and are fine examples of the tabulated statistics of the leading countries relating to their area, population, products, manufactures, transportation, communications, commerce, finances, etc.

OCEANIA.

GEOLOGY OF THE NEW HEBRIDES.—Mr. D. Mawson, Lecturer in Mineralogy at the University of Adelaide, spent six months of 1903 studying the geology of the New Hebrides, including the Banks and Torres groups to the north. On account of the extreme hostility of the natives and the prevalence in many places of malaria of an acute type, this group long remained a *terra incognita*. It was not until Missions were established in comparatively recent years that accurate knowledge of the geography and natural features was obtained. Geological knowledge of the islands was still very limited, and Mr. Mawson had before him an almost virgin field. The report he has written is published, with a number of fine photographs and a map, in the *Proceedings* of the Linnean Society of New South Wales for 1905, Part III., pp. 400-484.

Among the facts which attracted Mr. Mawson's attention were the great importance of volcanoes and volcanic material in the formation of the islands, and the arrangement of the volcanoes in definite directions. He also noted the immense size of many of the Pliocene and recent craters. He found that the chain of islands owed its existence primarily to the development during Miocene times of a fold-ridge, apparently a continuation of that which passes around the north of New Guinea through Sumatra, and on to the Himalayas. The folding period was preceded by local, shallow marine conditions, and the folding force seems to have been exerted from the direction of Fiji against the New Caledonia crystalline schists and gneisses to the west. A single ridge probably resulted, defining the western line of islands where extensive outcrops of Miocene strata are exposed.

Then a faulting of the inner wing of the fold occurred letting down the sea-floor to the east, and thus putting fairly deep water between the New Hebrides and the Fiji land surfaces. Large volcanoes were developed along this fracture, and the eruptions, beginning probably about middle Pliocene, have extended down to recent times. During all this period of volcanic activity extensive submarine tufaceous beds were accumulating above the folded Miocene series. No interbedded coral limestone is found among these tuffs. Capping these series are the raised coral reefs, elevated to heights of over 2,000 feet. The oldest of these is referred to a period not earlier than late Pliocene and probably not much later, as it has since been intruded upon by lavas from centres now extinct. If the New Hebrides ridge, at any time, formed continuous land connected with other land-masses, these conditions most likely prevailed in its early history.

The discovery that the New Hebrides are a fold-chain of Alpine age throws light upon our knowledge of South Pacific geology. It is apparent that the South Pacific island groups are lined along these great fold-chains concentric on the Australian land-mass. The fact that the land areas are not continuous is due to cross-faulting, the insufficient elevation of many ridges to rise above sea-level, and other causes.

The work of the industrious coral polyp has resulted in the development of three main types of islands: (1) In regions of continuous upheaval islands are veneered with coralliferous limestone terraces—*e. g.,* The New Hebrides; (2) islands situated on subsiding areas are typical atolls—*e. g.,* The Ellice group; (3) the third type of island is one in which coralliferous limestone is interbedded with submarine tuffs or other material, being evidence both of upheaval and subsidence. Such areas are, as a rule, larger land-masses, such as Viti Levu, and have been affected by oscillatory movements of the earth crust and by folding of the acute type defining most of the South Sea Island ridges.

POLAR.

PROGRESS OF THE ANGLO-AMERICAN POLAR EXPEDITION.—The BULLETIN (June, p. 382-84) announced the departure of the expedition led by Captain Ejnar Mikkelsen and Mr. Ernest de K. Leffingwell from Victoria, B. C., on May 20 in the schooner *Duchess of Bedford* for their field of work among the Western Parry Islands and their neighbourhood. Letters since received from Captain Mikkelsen say that the party spent a number of days on Kadiak Island, but did not see any bears during their sojourn. The course was then shaped for the Siberian coast to purchase dogs. Returning to the Alaskan coast, Port Clarence, a little south of Bering Strait, was reached about July 20. Dr. George P. Howe, the surgeon of the expedition, here came to the conclusion that Mr. E. Ditlevsen, naturalist and artist, was physically incapacitated for further service, and it was accordingly thought necessary to send him, as well as one of the sailors, back home.

On July 22 the *Duchess of Bedford* left Port Clarence, passed through Bering Strait, and on the 24th, in spite of strong head winds, reached Cape Hope, where the party was stormbound for four days. From that time they were considerably retarded by adverse winds, fog, and the presence of much Arctic ice along the coast. Leaving Cape Hope on July 29, Capt. Mikkelsen writes:

> The wind compelled us to take a true northerly course, and we struck the ice on Aug. 1 in Lat. 70° 30′ N. We followed up the pack, and on Aug. 2 came to land at Icy Cape, and had to put in two days at that point to give the ice a chance to clear away.

The schooner reached Point Belcher on Aug. 9, but from that time to Aug. 13 there was continual gale and fog. They finally broke out of the ice at noon on the 13th, and sailed in fairly open water to Point Barrow, the most northern point of the American mainland, only to find that the passage to the east of that place was not yet open.

The opening of the season along the Arctic coast of Alaska has, in fact, been very unfavourable. The winds have been light and persistent from the north, preventing the ice from clearing off the coast. None of the whaling vessels that were frozen in, last fall, east of Point Barrow, had put in an appearance at that place when Mikkelsen reached it. When he wrote, however, the barometer indicated a southerly wind, which would probably mean the opening up of the ice and a chance to pass east and make a fair advance before the season closed about the middle of September.

These conditions appear to have been fulfilled. When Mikkelsen wrote from Point Barrow on Aug. 18 he said that no news had yet been received from Amundsen; but we know now that Amundsen has since passed Point Barrow and through Bering Strait. The unfavourable season has rendered it problematical whether the party will be able to reach the destination in Minto Inlet, on the west coast of Prince Albert Land, where it had hoped to make its winter quarters; but if not, everything possible will be done to turn the winter to good account in collecting, surveying, and obtaining soundings offshore.

OBITUARY.

We regret to record the death on the 19th of July of Don Manuel Urbina y Altamirano, Chief of the Department of Natural History in the Museo Nacional, Mexico, and formerly Director *ad interim* of the Museum.

THE GEOGRAPHICAL SOCIETY OF TŌKYŌ sends information of the death of Viscount Moriyoshi Nagaoka, Vice-President of the Society and its principal founder.

NEW MAPS.

AFRICA.

EGYPT.—Egypt. Scale, 1:50,000, or 0.7 statute mile to an inch. Sheets: III-I S. E; I-I S. E. Survey Department, Cairo, 1906.

The second of these sheets shows the region west of the Nile between the Giza and Dahshur Pyramids, with the villages, roads, and canals.

EGYPT.—Topographical Map of Giza Province. Scale, 1:10,000, or 0.1 statute mile to an inch. Sheets: N. E. 1-2, S. E. 1-5, S. E. 1-6. Survey Department, Cairo, 1906.

ERITREA.—Carta Linguistica dell' Eritrea, Etiopia, e paesi limitrofi. Scale, approximately, 1:4,100,000, or about 65 statute miles to an inch. *Bollettino* of the Italian Geographical Society, Vol. VII, No. 7, Rome, 1906.

Messrs. Dante Odorizzi and Michele Checchi compiled this sketch map showing the distribution of the linguistic groups in Italy's African colony. The spoken languages and their distribution and the various regions and tribal divisions are indicated by different styles of type.

SAHARA.—Staub und Tier-Transporte aus der westlichen Sahara. *Geogr. Rundschau,* Vol. 28, No. 10, Vienna, 1906.

Illustrates an article by Wilhelm Krebs on the transportation by air currents of dust, birds, and insects, from the western Sahara to the islands of the west coast and the lands of western Europe. Symbols show the areas frequently covered by dust falls; also the areas over which land birds, butterflies, and dragon flies were transported by ships in the first five years of this century.

AMERICA.

U. S. GEOLOGICAL SURVEY MAPS.

ALASKA.—Reconnaissance Map of the Northern Portion of Kenai Peninsula. Scale, 1:250,000, or 3.95 statute miles to an inch. Contour interval, 200 feet. Washington, D. C., 1906.

The map illustrates Bulletin No. 277 on the mineral resources of the Kenai Peninsula. This region has a shore-line more than 1,000 miles long, and contains both gold and coal fields. The surveys on which the map is based were made in 1904, when more than 1,600 square miles were mapped topographically and all the producing gold placers of the peninsula were visited.

U. S. HYDROGRAPHIC OFFICE CHARTS.

Pilot Chart of the North Pacific Ocean, Sept., 1906.

UNITED STATES.—Geological Map of the Buffalo Triangle. Scale, 1:62,500, or 0.9 statute mile to an inch. New York State Education Department, Albany, 1906.

The map illustrates Bulletin 99 of the New York State Museum. It includes the city of Buffalo and its environs. Mr. D. Dana Luther resurveyed the area geologically, and the map presents accurate data in regard to the surface rocks and the succession of strata in Buffalo and its neighbourhood. With its accompanying text, it is a detailed guide to the rock sections of the region and the scattered and often obscure outcrops of the formations. On the margin is a stratigraphic section along the eastern boundary of the quadrangle.

BRAZIL.—Völkerkarte des Gebiets am oberen Rio Negro und Yapura. Von Dr. Theodor Koch. Scale, 1:3,000,000, or 47.34 statute miles to an inch. *Globus,* Vol. 90, No. 1, Brunswick, 1906.

The map shows the distribution of about fifty Indian settlements among the upper waters of the Rio Negro. These settlements are divided by tints into five linguistic groups. The map accompanies a paper by Dr. Koch on his important ethnological researches in this almost unknown part of the Amazon basin.

CHILE.—Die Skyring- und Otway-Buchten an der Magalhães Strasse. Scale, 1:750,000, or 11.8 statute miles to an inch. *Pet. Mitteillungen,* Vol. 52, No. 6, Gotha, 1906.

The map is based upon the original map published by the Chilean Hydrographic Office in 1904. It shows the changes that have been made in the mapping of the western part of Magellan Strait in the present century.

PERU.—Cróquis de Conjunto de las Provincias de Jauja y Huancayo. Scale, 500,000, or 7.8 statute miles to an inch. *Boletin* del Cuerpo de Ingenieros de Minas del Perú, No. 35, Lima, 1906.

One of the numerous sketch maps that the Mining Department of Peru is issuing, their special value being that they show the distribution of all the towns, pueblos, haciendas, mines, and hydrographic features.

PERU.—La Región Cuprífera de los Alrededores de Ica y Nazca. Scale, 1:500,000, or 7.8 statute miles to an inch. *Boletin* del Cuerpo de Ingenieros de Minas del Perú, No. 29, Lima, 1905.

Shows the geological formations, mines of copper and gold, railroads, and rivers.

PERU.—Cróquis de la Provincia de Arica. Scale, 1:500,000, or 7.8 statute miles to an inch. Trazado por Carlos Larrabure y Correa. *Boletin* of the Geographical Society of Lima (Vol. 15, No. 2, 1905).

The map shows the southern limit of the territorial claims of Peru in the still unsettled boundary dispute between that country and Chile.

ASIA.

DUTCH EAST INDIES.—Schetskaart der Rokan Landschappen. Scale, 1:300,000, or 4.73 statute miles to an inch. Topographic Bureau, Batavia, *Tijdschrift* voor Indische Taal, Land-en Volkenkunde. Vol. 48, No. 5, 1906.

The results of a topographic survey of a district in east central Sumatra.

INDIA.—Geological Sketch Map of a portion of Sausar Tahsil, Chhindwára District, C. P. Scale, 1:63,360, or 1 statute mile to an inch. *Records* of the Geological Survey of India, Vol. 33, Part 4, Calcutta, 1906.

Illustrates notes on the rock formations and the manganese ore deposits of this district in the Central Provinces.

INDIA.—Geological Sketch Map of Portion of Bhutan. Scale, 8 statute miles to an inch. *Records* of the Geological Survey of India Vol. 34, Part 1, Calcutta, 1906.

Illustrates a geological reconnaissance by Mr. Guy E. Pilgrim along the border of the sub-Himalayas in Bhutan. His observations seem to confirm the earlier view that from Nepal eastward there are more or less continuous outcrops of the clays and sandstones of the upper Siwaliks, the quartzites and graphitic schists of the Gondwana beds, and the Purána metamorphic rocks; these formations being mentioned here in the order in which one meets them going inward from the plains into the foothills.

AUSTRALASIA.

Australia.—Carte des Missions Catholiques en Australie. Scale, 1:5,000,000, or 78.9 statute miles to an inch. *Les Missions Catholiques,* July 6, 1906, Paris.

The Roman Catholics divided the entire Australian continent into ten Archdioceses, whose boundaries are given on this map, together with the boundaries of the ordinary Dioceses and Vicarates as far as they have been organized in the more settled parts of the continent. The Mission stations are so numerous that they are indicated only by the residences of the archbishops, bishops, and vicars. The special information is imposed upon an excellent map of the continent showing the land-forms, hydrography, and cultural features.

Polynesia.—Verkehrskarte der nordwestlichen polynesischen Inseln. By G. Thilenius, in "Ethnographische Ergebnisse aus Melanesien." Part 1. *Abhandlungen* der Kaiserl. Leop.-Carol. Deutschen Akademie der Naturforscher. Band LXXX. No. 1.

These islands extend along the eastern border of Melanesia from New Guinea to Samoa. Black lines connect these sea routes.

EUROPE.

Austria.—Sprachenkarte von Kärnten. Scale, 1:200,000, or 3.1 statute miles to an inch. By Dr. Martin Wutte. *Deutsche Erde,* Vol. 5, No. 3, Gotha, 1906.

Based upon the census of 1900. Tints show the percentages of Germans and Slavs living in each area of Carinthia. The map illustrates an article by Dr. Wutte.

Scandinavia.—Sveriges, Norges och Danmarks Järnvägar vid slutet af år 1903. Scale, 1:3,200,000, or 50 statute miles to an inch. Allmän Svensk Järnvägsstatistik för år 1903. Published by the Government, Stockholm, 1903.

The state railroads are shown in red and all others in black. The lines are also distinguished as standard or narrow gauge.

Iceland.—Geologische Karte von Island. Scale, 1:750,000, or 11.84 statute miles to an inch. By Dr. Th. Thoroddsen. *Petermanns Mitteilungen,* Ergänzungsheft, No. 153, Justus Perthes, Gotha, 1906.

A beautiful product, illustrating the second volume of Dr. Thoroddsen's extended study of the geography and geology of Iceland. Thirteen symbols are used to show the distribution of the geological formations and glaciers and fourteen others to indicate the position of hot and mineral springs, raised beaches, volcanoes, fossil plants and shells, etc. This map is the companion piece of the Höhensschichten-Karte von Island accompanying the first part of Dr. Thoroddsen's study (Ergänzungsheft 152).

OCEANOGRAPHY.

Atlantic Ocean.—Anlotung von Freetown. Annal. d. Hydrog. u. Mar. Meteorologie, No. 8, Deutsche Seewarte, Hamburg, 1906.

Illustrates an article on the oceanographical work of the German steamer

Planet in the Atlantic. Nineteen soundings were made from Freetown to a little west of 15° W. Long., where a depth of 4,743 meters was attained. A series of soundings showed the relatively steep descent of the continental shelf to deep-sea depths. A profile gives the contour of this section of the sea-floor, the vertical scale being exaggerated tenfold.

ATLANTIC OCEAN.—Lotungen S. M. S. Planet. From *Annalen* as above.

This work was west of Walfish Bay, Africa, showing that the Walfish Ridge in the Atlantic, off this Bay, is a comparatively small elevation of the sea-floor, with an average depth over it of about 2,500 meters.

GULF OF BOTHNIA.—Der Bottnische Meerbusen. Annalen d. Hydrog. u. Mar. Met., No. 8, Deutsche Seewarte, Hamburg, 1906.

Accompanies a paper by Rolf J. Witting on the Gulf of Bothnia. Five tints distinguish the contours of depths; the positions of lighthouse and lightships are shown.

ATLASES.

ATLAS OF THE WORLD'S COMMERCE.—Compiled from the latest Official Returns at the Edinburgh Geographical Institute. Edited by J. G. Bartholomew. (Part 8.) George Newnes, London, and Frederick Warne & Co., New York, 1906.

Includes a General Commercial Chart of North America, coloured to show the predominating forms of vegetation, cultivated areas, desert and tundra, transportation and telegraphs, and a diagram of the vertical distribution of vegetation; the United States, coloured to show arable and grazing lands, manufacturing districts, with letters at the manufacturing towns indicating the nature of the chief industries, and commercial diagrams; the Dominion of Canada, coloured to show regions of cultivation, intensive cultivation, and industrial districts, with export and import diagrams; a commercial Chart of South America, coloured to show distribution of vegetation, communications, and transportation; the West Indies and Central America, with chief products lettered in red and commercial diagrams. The description of the commodities of commerce is carried forward from Palma Christi to Rags.

ANDREES ALLGEMEINER HANDATLAS.—In 139 Haupt und 161 Nebenkarten, nebst vollständigem alphabetischem Namenverzeichniss von etwa 240,000 Namen. Fünfte, völlig neubearbeitete und vermehrte Auflage. (Lieferungen 37-42): Herausgegeben von A. Scobel. Velhagen & Klasing, Leipzig, 1906. (Price of complete work, M. 28.)

The new edition of this standard atlas is now three-fourths completed. The ten double sheets in these numbers include four maps showing density of population and distribution of rainfall in Europe; the northern half of England and Wales; Eastern Asia from Japan to Persia, with a clear delineation of the topography; the explored and unexplored parts of rivers are sharply defined. A double sheet of the northeastern part of Africa, containing the many changes which recent explorations have made, adds, if anything, to the high reputation this atlas has enjoyed for its Africa maps. A double sheet is given to fifteen maps of the most important Pacific Islands. The double sheet of the northern part of India is conspicuous for its plastic delineation of the Himalayas and the clear printing of names in the mountain regions. A notable feature of this edition is the large number of hydrographic soundings and the tinted contours of sea depths.

BOOK NOTICES.

Hydrographic Surveying—Methods, Tables and Forms of Notes. Samuel Hill Lea, M. Am. Soc. C. E. · New York: The Engineering News Publishing Co., 1905.

This is a valuable Manual, setting forth the best modern practice in all kinds of hydrographic surveying, excepting marine hydrographic surveying in its more comprehensive forms. The book does not digress into those fields of engineering that embrace a consideration of the factors which affect the choice of sites for engineering structures, nor into the mathematical theories that underlie hydrographic surveying and the gauging of the flow of streams; it is confined to the practical needs of the surveyor who would conduct in the best manner the work that falls to his assignment.

In reaching this meritorious aim of setting forth plainly and directly what are the operations and computations comprised in hydrographic surveying and how they are carried out, the author has conferred upon students and beginners the important advantage of having at their service what would otherwise come to them only through extended experience in actual work in the field. G. W. L.

Géographie de l'Empire de Chine. (Cours Supérieur.) Par L. Richard. xviii, 564 and xxii pp. Many tables, maps, figures, and Index. Imprimerie de la Mission Catholique, Shanghai, 1905. (Price, $3.80 Mexican.)

Géographie de l'Empire de Chine. (Cours Inférieur.) Par L. Richard, xx and 272 pp. Tables, maps, figures, and Index. Imprimerie de la Mission Catholique, Shanghai, 1905. (Price, $1.80 Mexican.)

These text-books are in French, with all place-names also given in Chinese characters. The author had access to much information not readily obtained, and his books are a unique contribution to text-book literature. They are intended for Chinese students who are studying French in the mission schools of the Empire. The information is condensed, but is in astonishing variety, and is carefully compiled. The larger book especially will be valuable in any reference library, because it contains many facts not commonly known. Special attention is paid to physical geography, and the geology of various regions is also sketched. Much importance is given to commercial geography, indispensable in geographical treatises used in Chinese schools, because many of the students are the future merchants of the country. The comprehensive bibliographies in both books add much to their value, and statistics of most parts of the Empire are brought down to 1905. The maps, black-and-white and coloured, are numerous, but inferior in merit to the text, though many maps give numerous details, rather roughly presented, which we are not accustomed to see.

Die Barometrische Höhenmessung, mit neuen Tafeln, welche den Höhenunterschied ohne Zuhilfenahme von Logarithmentafeln zu berechnen gestatten. Von T. Liznar, O. Ö. Professor an der K. K. Hochschule für Bodenkultur in Wien. Leipzig und Wien: Franz Deuticke, 1904.

The author has given a thorough demonstration of the theory of the barometric measurement of heights by a method which is characterized by simplicity and brevity and which is different from the ordinary methods and partly new. Supposing the atmosphere to be in a state of equilibrium, the investigation is founded upon the consideration of a column of air having a cross-section of one square-meter. The weight of a given volume of this air depends on the pressure, p, the temperature, t, the humidity, e, and the acceleration of gravity, g, which is a function of the height, h, and the latitude, ϕ.

The formula for computing H, the difference of altitude between two stations whose heights are h_1 and h_2 is found to be—

$$H = 18400 \left\{ 1 + \alpha \frac{t_1 + t_2}{2} - \frac{\alpha^2}{12} (t_1 - t_2)^2 \right.$$
$$\left. + 0.377 \frac{4560}{H} \cdot \frac{e_1}{p_1} \left(1 - 10^{-\frac{H}{10500}}\right) \right)$$
$$+ \frac{2h_1 + H}{R} + 0.0026 \cos 2\phi \left\{ \log \frac{p_1}{p_2}, \right.$$

in which ϕ is the coefficient of expansion of air, and R is the radius of the Earth.

Putting H^1, the approximate value of H, equal to $18400 \log \frac{p_1}{p_2}$, there results

$$H = H^1 + \alpha \frac{t_1 + t_2}{2} H^1 - \frac{\alpha^2}{12} (t_1 - t_2)^2 H^1$$
$$+ 0.377 \frac{4560}{H} \cdot \frac{e_1}{p_1} \left(1 - 10^{-\frac{H}{10500}}\right) H^1$$
$$+ \frac{2h_1 + H}{R} H^1 + 0.0026 \cos 2\phi\ H^1$$

Therefore, in order to find H, the approximate value H^1 should have the following corrections applied to it:

(1) On account of atmospheric temperature, $\underset{t}{C} = \alpha \frac{t_1 + t_2}{2} H^1$

(2) “ “ “ “ “ , $\underset{t}{C^1} = \frac{\alpha^2}{12} (t_1 - t_2)^2 H^1$

(3) “ “ “ “ humidity , $\underset{e}{C} = 0.377 \frac{4560}{H} \frac{e_1}{p_1} \left(1 - 10^{\frac{-H}{10500}}\right) H^1$

(4) “ “ “ “ gravity due to altitude, $\underset{g}{C^h} = \frac{2h_1 + H}{R} H^1$

(5) “ “ “ “ “ “ “ latitude, $\underset{g}{C^\phi} = 0.026 \cos 2\phi .\ H^1$

The approximate value of H^1 is obtained in the following manner:

$$h^1_2 = 18400 (\log 762 - \log p_2)$$
$$h^1_1 = 18400 (\log 762 - \log p_1)$$
$$H^1 = h^1_2 - h^1_1.$$

The corrections (1), (2), (3), (4), and (5) are conveniently tabulated by the author in such a manner as to simplify the computation of heights by obviating the necessity for the use of logarithmic tables and by giving directly in meters the corrections for temperature, humidity, and gravity.

G. W. L.

La Bretagne, par Gustave Geffroy. Illustrations d'après les Photographies de M. Paul Gruyer. Hachette et Cie., Paris, 1905. 4to.

It always affords pleasure to find a book the author of which is in love with his subject; and such is the case with Mr. Geffroy. To him, Brittany is, not a paradise, but a great poem, a weird dream. Hence what he has written concerning it—a volume of nearly 450 pages, " édition de luxe," with most beautiful photolithographs—is to be judged from its literary aspect only, since the author makes no claim to scientific accuracy or to present systematic information on the geography of the country. Still, there is useful material, but dressed in a garb that would be exquisite if it were plainer, more simple. The author carries one through all Brittany, entering the peninsula from the north (the side of Normandy), and traversing it in almost every direction to its three seaboards. It is the journey of a literary tourist, prepared for his self-imposed task, as far as an eye for the striking is concerned, and sufficiently familiar with the history of the country to season his descriptions, and temper them with legends and facts from the past. The views and portraits of people and costume, due to Mr. Paul Gruyer, contribute to enhance the value of the work.

The enthusiasm of the author for the land of Brittany is justifiable. Few parts of France contain so much of interest in the works of man, archaic, mediæval; in every branch of art, be it sculpture, painting, architecture, or other. But the *quaint* predominates; the comparative geographic isolation of Brittany and its seclusion have had their influence on the culture of the people. The landscape is not uniformly prepossessing, nor is the land uniformly productive. The people have preserved a wealth of customs of old, as well as their local costume. They are doubly interesting on that score, and Mr. Geffroy makes the utmost of it, in word as well as in picture. His judgment about the great men of Brittany is, although influenced, of course, by the "immortal principles of 1789," not offensively flippant; while (after the present fashion in France) he treats religious faith and creed as a thing of the past, and bound to disappear as soon as people "learn to read and write," he still refrains from attempting to ridicule ceremonies in which the people sincerely believe. His judgment of Chateaubriand is pleasing to read. It is not a panegyric, but a fair acknowledgment, with sufficient allusions to that great writer's failings.

What detracts considerably from the merits of the work is its manner of treatment. Every village, every town or city, is rehearsed in the same fashion. First the history is rapidly sketched, then the artistic detail and the architectural description; always in the same order. This, in the compass of over four hundred pages, becomes very monotonous. Still more so is the author's habit of constantly using, not only comparatives, but superlatives. Even domestic animals do not escape his predilection for a sort of poesy in swelling prose. Not a page is free from this fault.

Of natural history Mr. Geffroy has no idea, so far as Brittany is concerned; and he seems to know only the names of the animals he mentions. A. F. B.

Relación de los Naufragios y Comentarios de Alvar Nuñez Cabeza de Vaca, Adelantado y Gobernador del Rio de la Plata. Ilustrados con varios documentos inéditos. Tomos 1 and 2. (Colección de Libros y Documentos Referentes á la Historia de América. Tomos V and VI.) Madrid, Victoriano Suárez, 1906.

It cannot be said that these two octavo volumes are uncalled for. They present the advantage, to the student whose means are limited, of giving the text of original prints that are very rare, and of reproducing that text in a type which is much more readable than, for instance, the version of Enrique de Vedia in his "*Historiadores* *de Indias*." The Editor might, however, be censured for giving only the text of the 1555 edition of the *Naufragios*, whereas it would have been infinitely more valuable had he copied and properly annotated that of 1542, published at Zamora. But against such an eventual reproach we must defend him. He knew of the existence of that *editio princeps;* but there are, as far as known, only two copies of it in existence. One of these, in a perfect state, is at the Lenox Foundation of the New York Public Library; the other, an imperfect copy (in which the pages lacking have been supplied by photolithographic reproductions), is in the British Museum. Such extreme rarities are not easily accessible from a great distance. The text of 1542 differs from that of 1555 in some respects, and these discrepancies are not as immaterial as the Editor of the two volumes before us fancies them to be. Neither is his rendering of the version of 1555 always exact. He has, with very laudable intent, endeavoured, in some instances, to elucidate the often confused original text—a thing that should never be done unless in footnotes or in an introduction.

The Editor's comments on the two books written by Cabeza de Vaca are, fortunately, limited. To state that the customs of the Pueblo Indians of New Mexico were nearly the same as those of the shifting tribes of Texas, and to quote the manuscript of Villagutierre y Sotomayor: "*Historia de la conquista, perdida y restauracion de la Nueva Mexico*" as a source of primary importance shows, first, that the Editor has a most insufficient knowledge of the bibliography on the subject; secondly, that he has not the least shadow of an idea about the regions traversed and the aborigines met in the sixteenth century. The same applies to his appreciation of the cures effected by Cabeza de Vaca and his companions, after they had been compelled to become "medicine-men" for the Indians. With the insignificant basis on which he rests his judgment it would have been far better, for his own sake, had he desisted from expressing any. His comments on the career of Cabeza de Vaca in Paraguay are less objectionable, because they are shorter. He defends Cabeza de Vaca from the unjust slurs cast upon him by Azara, to a certain extent, and makes the true remark that he "used to sin more from want of energy than through acts of violence."

In the first volume the edition of 1555 is recorded as the first, while in a footnote to the "Advertencia" to the second volume the Zamora print of 1542 is mentioned as the first. The well-known report of Hernando de Ribera of 1545 follows at the end of Cabeza de Vaca's "Comentarios." A. F. B.

Jahrbuch des Schweizer-Alpenclub. Jahrgang XL, 1904–1905. Bern: A. Francke (vormals Schmid & Francke), 1905.

Statistics of accidents in the Alps, during the year 1904, sum up 49 cases, with 58 deaths. This is a slight increase over 1903, and is accounted for by a more favourable season and a corresponding increase of tourists. Three of the accidents occurred in winter, sixteen took place in the highest regions, and thirty-three in the subalpine. Only two guides lost their lives; fourteen tourists were killed while venturing alone into the range of lofty summits and glaciers far above the line of perpetual snow, and hence were victims of their own temerity. The other deaths were due to natural phenomena (avalanches, fog, and the like), to loss of foothold, exhaustion, etc.

In connection with such statistics the first section of the year-book becomes of special interest. The excursions and ascents therein described were of peaks least frequented, over crests and passes of most dangerous character. It is perhaps questionable whether the risks are in proportion to the results, whether it is worth while for valuable lives to run the gauntlet of destruction so often and so rashly. Especially in a country so thoroughly "ascended" as Switzerland!! It becomes also tiresome to follow the rhetoric of a devoted acrobat over hill and vale, glaciers to kill, up "chimneys," along dizzy "bands," finally up something akin to Cleopatra's Needle to a bare point of rock, whence he surveys the identical panorama of "peaks, passes, and glaciers" enjoyed all around; only from a different angle. Some of the articles are of value, like that of the remarkable tour from Meyringen (Berne) to Chamouni in Savoy, climbing and vaulting nearly every tall peak that lies in the way, avoiding carefully what is easy and safe; and the "rambles of a guideless photographer." The chief results of these perilous adventures are the magnificent photographs published in this volume. They are, to the still-life of the Alps, what successful views of dense forests would be to the exuberance of the tropics. The detailed structure of imposing solitudes of rock, snow, and ice is represented with unsurpassable minuteness, and with a degree of artistic sense, that cannot be too highly commended. At the end of the first section is a valuable paper by Dr. Andreas Fischer (Basle), headed "In the Caucasus," and describing his ascents and explorations in the Abkhasian Alps; accompanied by a sketch-map of the mountain triangle within the courses of the Tschkalta, Kodor, and Gonatschkir Rivers. The highest points reached seem to have been: in the Abkhasian group the Dombai (4,051 meters = 13,287 feet), and later on the gigantic Elbruz (5,629 meters = 18,463 feet). Not content with that very respectable feat, Dr. Fischer and his companion, Mr. Alexander von Meck, President of the Russian Alpine Club, also ascended the Kuru Tau (4,091 meters). A map of the Elbruz group is given from Russian charts on the scale of 1:210,000. The photographs accompanying the paper are worthy of the book in which they are published. Dr. Fischer calls his paper a mere sketch; still he finds space to refer frequently to the remarkable beauty of the region, the grandeur of the mountains, their picturesque forms (well given in the photographs), and the magnificent vegetation sweeping up to the very glaciers. Had the Caucasus the placid lakes for which Switzerland is so justly celebrated, it would, in its actual state of undefiled nature, probably be superior to anything the Alps can offer. No wonder that such scenery, merely indicated by Dr. Fischer, inspired in the late Gerhard Radde the inimitable beauty of his descriptive style.

The second part of the year-book, embodying specially scientific papers, begins with one on the periodic variations of the Swiss glaciers. It results, from observations made on many glaciers from 1897 to 1904 inclusive, that retrocession is very marked. But the same table also seems to indicate that the retrocession attained its maximum in 1900 and 1901, increasing annually up to that time and decreasing correspondingly afterwards. Still, the authors of the dissertation show that the snow-falls in the high Alpine region (hence local meteorologic phenomena) may become a factor not to be neglected. It is to be noted that glacial retrocession in the Andes of Peru and Bolivia has been very strongly marked since 1894. The short article on photographing in the Alps might well have been omitted; especially the two vignettes in the beginning and at the end, showing the author in attitudes recalling the German rhyme: "Mit Stiefel und mit Sporn, von hinten und von vorn."

The extensive discussion, by A. Wäber, of "Names of the Valais Mountains and Passes in the XIX Century" furnishes a voluminous bibliography of the Swiss Alps, beginning with Bonstetten's *Superioris Germaniæ Confederationis Descriptio* (1479–80) and is brought down to about 1801. There is considerable obscurity yet in regard to most names, and the remarkable collection of documents relating to the Canton of Valais published by the Abbé Grémaud, which embodies documents from 300 A.D. to

1457, only mentions the Balmhorn. Of passes, the St. Bernard and the Simplon appear first under recognizable appellatives in the *Claudii Ptolomæi Cosmographia* of Donis in 1482 (Nicolaus Germanus). On the map of 1548 by Johannes Stumpf, Zermatt is recognizable, and the Mons Martis may stand for the group of peaks culminating in Monte Rosa, although Mr. Wäber identifies it with Monte Moro. But it is likely that not single summits, but groups (massifs), were meant by such names as Antrun Mons, Mons Martis, Mons Sylvius ; the last referring to the region of the Matterhorn (Matterjoch). The author insists, perhaps too strongly, on the fact that passes appeared earlier in orographic nomenclature of Switzerland than summits. That the Mons Martis is intended for the Monte Rosa cluster is shown by the course of streams on the 1548 map. That the word "rosa" should mean a glacier, in the dialect of the Val d'Aosta, furnishes a more plausible and likely ethnology of the second highest mountain in Europe than the explanations generally admitted. The Valais was much less known than, for instance, the Bernese Oberland, where the Eiger (Mons Egere) and the Eiger-Rotstock (Truncus rubeus) are mentioned, in documents, already in 1252.

Among the remaining contents of this interesting year-book may be mentioned the long list of explorations during a part of 1903 and 1904, the crossing from Lenk to Leuk (les-Bains) by Küttner in 1780, and several of the reviews. One of these calls attention to the importance of Coolidge's book on Josias Simler and the origins of Alpinism as far as 1600 (Grenoble 1904). A. F. B.

Du Transvaal à Lourenço Marques. Lettres de Mme. Ruth Berthoud-Junod. Publiées par Gaston de la Rive et Arthur Grandjean. 308 pp. Map, 28 Illustrations, and Appendix. George Bridel & Co., Lausanne, 1904. (Price, 3 fr.)

The author was a missionary's wife who, with her husband, made an overland journey, by ox team, from the Transvaal to Lourenço Marques, where they established a mission. Their success in the mission field was gratifying. Mme. Berthoud-Junod died in 1901 after nearly twelve years in Africa. Her letters are no commonplace description of missionary experiences. With a vivid pen the author sketched travel in Africa, the natives, and missionary work. She had an eye for the picturesque and the uncommon. She was writing to friends and not for the public, which may explain in part her naturalness and the ease and grace of her descriptions. The letters are worthy of preservation in book form.

Bilder aus Südasien. Von Pauline Gräfin Montgelas. 146 pp. 6 Illustrations, and a Sketch Map. Theodor Ackermann, Munich, 1906.

A very readable account of the travels of the Countess de Montgelas in her extensive journey through Cochin-China, Cambodia, Siam, Java, Burma, and India. It is not frothy nor diffuse, but the writer describes succinctly what she saw that she regarded as most worthy of comment.

L'Ubaye et Le Haut-Verdon. Essai Géographique par F. Arnaud. 216 pp., and Maps. Published by the author, Barcelonnette, 1906.

Mr. Arnaud says that Alpinists and tourists who use the French Staff map on the scale of 1:80,000 find that much information of importance to tourists is lacking on the sheets. Among the mountains of southern France, for example, there are areas of ten square kilometers in which there is not a single name.

The book was prepared to correct errors on the Staff map and supply information which the sheets lack. The criticisms and information are confined to the sheets of Ubaye and Haut-Verdon. The author makes 106 corrections in the 735 place-names on the map and adds the names of 1960 new places, streams, hills, etc.

Geography of New Zealand. By J. R. MacDonald. vi and 118 pp. 29 Maps, and 16 Illustrations. Gordon & Gotch, Lim't'd, Wellington, 1903.

A small book intended for pupils in the higher geographical classes. It is full of information, the more important matter being in large type, with details in smaller type under it. Special attention is given to topography, commerce, communications, and places of interest for tourists, which is doubtless the reason why the Department of Tourists and Health Resorts of New Zealand is calling attention to the book.

Om Eskimokulturens Oprindelse. Af H. P. Steensby. 219 pp., and Bibliography. Salmonsen Bros., Copenhagen, 1905.

An ethnographical and anthropo-geographical study of the Eskimos, in which the author discusses the various theories as to their origin, describes Eskimo types as they have been studied in their habitats, and compares the Eskimos with Indian tribes of the northern part of this continent.

Instrumentenkunde für Forschungs-Reisende. Von C. Seidel und W. Müller. viii and 200 pp. Illustrations. Dr. Max Janecke, Hannover, 1906. (Price, M. 4.40.)

A copiously-illustrated list of the various instruments used in field work by explorers, with information as to the purposes they serve and how to use them. Manufacturers and prices are mentioned.

The Mariner's Pocketbook. A Handy Reference Book for Navigators, Yachtsmen, Seamen, etc. By International Correspondence Schools. xxi and 324 pp. Many Diagrams and Index. International Text-book Company, Scranton, Pa., 1906.

A handsomely-printed book, fitted for the pocket and containing much of value, not only for seamen but also for students of mathematical geography and meteorology. It shows the use of logarithms, methods of determining latitude and longitude, how to construct a Mercator chart, treats of the deviation and dip of the compass needle, and the necessary compensations, and gives a large number of other facts and tables.

A New Geography of Japan, for the Upper Forms of Schools and Colleges. By C. D. Mitford. 32 pp. Maps and Illustrations. Japan Gazette Press, Yokohama, 1906.

A concise treatment of the islands in their various geographical aspects by a writer who is familiar with modern methods of writing and teaching geography. Special attention is given to physiography. In describing important cities, the physiography of the region around them is outlined. One map shows, what we seldom see in atlas sheets, the 84 provinces of the Empire clearly distinguished from one another by colour.

A Practical Manual of Tides and Waves. By W. H. Wheeler. viii, and 201 pp., 7 Appendices, Index, and 18 Illustrations. Longmans, Green and Co., New York, 1906. (Price, $2.80.)

This is a desirable addition to the books on physical geography. It gives a practical account, free from technicalities, of the action of the sun and moon in producing the tides and of the physical conditions by which tides are affected after their generation. A chapter is devoted to the history and development of tidal science. It received no large attention from the ancient astronomers, but the author shows how prominent were Copernicus, Kepler, Galileo, and Newton in its development. The relation of the sun and moon to the earth, a simple and practical discussion of the theory of tides, the propagation of the tidal wave, tidal currents, the range of tides—or, in other words, the difference in level between high and low tidal waters, river tides, tidal bores, wind waves, tide measurements, and tides as a source of power—are chief among the other topics discussed. The author points out the common error of calling earthquake and wind waves "tidal waves." A bibliography and tables make up the appendices. This practical handbook should be accessible to every teacher of physical geography. Unfortunately, there are many misprints, such as Cape La *Hague*, *Obydos* and *Abydos* (for Obidos, on the Amazon), *Tapagos*, Cape de Norte, *proroca*, and others. Cape Roque is printed for Cape St. Roque, and on page 145 Mr. Wheeler plays with the Pacific and the Amazon and geography itself in one line:

> The Amazon enters the Pacific on the north coast of South America.

India and Her People. By Swami Abhedananda. 285 pp. and portrait. The Vedanta Society, New York. 1906. (Price, $1.25.)

The Swami Abhedananda, a native of India, is known best as a lecturer and writer on the Vedanta philosophy and religion. He has travelled extensively, spent a year in England, and has lived for the past nine years in the United States. This book, therefore, among many treating the same subject, has more than usual interest as coming from one who knows the Occident, and both knows and loves the Orient.

The book consists of lectures delivered before the Brooklyn Institute of Arts and Sciences during the season 1905-6. The subjects covered are the Philosophy and Religion of India, the Social Status of the Indian People, their Political and Educational Institutions, English Rule, India's Need, and, finally, the Reciprocal Influence of Eastern and Western Civilization. Each topic is treated from the historical point of view, present conditions being shown in relation to their origin and development. Thus, the lecture on "The Political Institutions of India" describes, first, the state of civilization existing among the ancient Indo-Aryans, and ample evidence is drawn from such Sanskrit writings as the Rig Veda, the Mâhabhârata, the Ramayana, the Laws of Manu; also the writings of Megasthenes, and the letters of Chinese travellers, to show that an advanced system of government prevailed in India before the beginning of the Christian era. Then the effect of successive invasions upon the development of political institutions is traced.

The author pictures graphically the poverty and suffering of the Indian people of to-day, and their need of greater educational opportunity. English rule is strongly criticized as "tyrannical," and this view is supported with statistical statements and quotations, especially from English writers and statesmen. Such facts as that India never knew a terrible famine until after the beginning of British rule; that the Indian Government spend annually only £750,000 for education of the natives, while the military expenses are nearly 36 times as great (nearly £27,000,000); that native industries have been crushed by prohibitive tariffs, and that, as stated in the Report of the Select Committee, "a large proportion of the revenue is annually drained away, without any return being made for it," while the people of India "have no voice whatever in imposing the taxes which they are called upon to pay"—these alone are sufficient evidence to justify severe censure. The Swami, however, expresses gratitude to England for the two benefits which, he acknowledges, she has conferred upon India: the reawakening of a national pride, and the chance to learn of the science, business enterprise, and culture of the West. As for religion, the Swami holds that the West has yet much to learn from India.

The book is decidedly interesting. Owing to the necessary brevity and popular nature of the treatment, many historical portions are too scantily filled in, and many statements which should be strengthened with a greater backing of facts are left with but little more weight than expressions of opinion. Still, for the student, the book has two admirable qualities: breadth in scope, and suggestiveness in material.

J. B. A.

Pictures from the Balkans. By John Forster Fraser. xii and 298 pp. Map, Illustrations, and Index. Cassell & Company, London, 1906. (Price, $2.)

Mr. Fraser is the British journalist who wrote "Canada As It Is," which was issued by the same publishers over a year ago (BULLETIN, 1905, p. 700). He has brought the same qualities of shrewd observation and lively description to the drawing of these pen-pictures from the Balkans—a region which, in every sense, is much more complicated than his earlier topic. The sketches are drawn from Servia, Bulgaria, and those western parts of Turkey commonly called Macedonia and Albania.

He says that Macedonia is little more than a name given to a tract of Turkish territory where, besides the Turks, lives a congeries of races, chiefly Bulgarian and Greek; and it is the hatred between the Bulgarian and Greek Christians that is responsible for a large part of the outrages to which so much attention has been called. All curse the Turk and love Macedonia, but it is Greek Macedonia or Bulgarian Macedonia. This bitter animosity between the Greek and Bulgarian Christians is responsible for the larger part of the ills of their country:

> The misrule of the Turk is bad enough, but to hand over Macedonia to the Christians of Macedonia to work out their own salvation would be to plunge the country into direst bloodshed.

The book makes no special appeal to the geographer, but it offers to the general reader many glimpses of the Balkans and their people that are most acceptable in these days, when good descriptions of that region are still few in number.

Ten Thousand Miles in a Yacht round the West Indies and up the Amazon. By Richard Arthur. 253 pp., and many Illustrations. E. P. Dutton & Company, New York, 1906. (Price, $2.)

This is a vivacious account of the yacht voyage made in the winter of 1904–5 by Mr. E. C. Benedict and his party of guests to Bermuda, the West Indies, and up the Amazon as far as Manaos, about 1,000 miles inland. It was Mr. Benedict's original intention to extend the journey to Iquitos, 2,200 miles from the ocean—a point that is reached by large steamers from Europe, but it was decided that practically every phenomenon of the river had been revealed in the first thousand miles, and that there was little to gain in experience or pleasure by going any farther. The journey was about 10,000 miles in length, and occupied 76 days.

Nothing geographically new could be expected from a narrative of this kind, but it is not often that the enjoyment, variety, and interest of a pleasure journey are more charmingly described. Every facility was given to the distinguished party at the Amazon and island towns they visited to see everything worth seeing, and they were after information as well as pleasure. The book has been handsomely produced, and contains numerous fine photographs. The preface is written by Mr. William M. Ivins, the well-known lawyer, who, through residence, travel, and study, knows many things Brazilian. He expresses regret that the English books of value on Brazil were not all written by men who knew thoroughly the tongue, history, literature, or people of that country ; so that we are not yet in real touch with their lives, national aspirations, customs, or civilization.

Alaska and the Klondike. By J. S. McLain. xiv and 330 pp., numerous Illustrations, Map, and Index. McClure, Phillips & Co., New York. (Price, $2.00.)

The author is a newspaper editor who was permitted to accompany the senatorial Sub-Committee that visited Alaska in the summer of 1903 for the purpose of collecting information that would be useful to Congress in its legislation for that district. Mr. McLain, therefore, enjoyed extremely favourable opportunities for studying the resources and prospects of the country during the ten weeks' trip through the interior, along the whole course of the Yukon, and to many places among the islands and on the coast that are not easily reached by the regular means of travel.

His book has two qualities that make it conspicuous among writings on Alaska. It has the solidity essential to the presentation of a large amount of reliable, late, and well-digested information; and it contains sufficient narrative, anecdote and description to make it interesting to a large circle of readers. It first tells the story of the trip along the coast and through the heart of Alaska. It then discusses the very important interests and questions relating to the country, such as the seal islands and the fisheries, transportation as the key to the locked-up wealth of Alaska, the political conditions, agricultural possibilities, the reindeer industry, the Indians, and the great goldfields of the Seward Peninsula and the Fairbanks district.

The predominant note is that Alaska is a wonderfully rich country. The author is even impressed with the probability that in the interior, where food supplies from the States must always be expensive, it will be practicable and profitable to produce meat, dairy, poultry, and garden products in sufficient quantity and at such prices as to solve the problem of development of large areas of gold-bearing gravel. This is very important, for the prospects are that before many years there will be hundreds of toilers in the Territory where there are tens to-day. The Sub-Committee was told in Nome that in this district about 20,000 gold claims had been staked out and recorded, and only about 500 of them were being worked to any extent. This represents a state of things general throughout Alaska, though it is not quite so accentuated in other sections as in the Seward Peninsula.

It is impossible to give an idea of the stores of information the book contains, but a few facts may be mentioned about the new Fairbanks district. The miners, not satisfied with the price of $16 an ounce for their gold, had it assayed, and found it to be worth $17.50, which shows that it is a finer quality than that of the Klondike and nearly as fine as the gold of Nome. It is more inaccessible, however, than at either of those places. In the Klondike and Nome regions the gold is often found exposed or very slightly covered along the beds of the creeks, but in the Fairbanks district there seems to be no gold in the creek bottoms; it lies up on the ledges and on the hillsides in a stratum of gravel two or three feet thick, and is located only after sinking shafts 10 to 20 feet from the surface.

We have scarcely appreciated the isolation of Nome in winter:

> The mining has stopped almost entirely, the ships come no more, half the people have gone "outside"; the rest eat and sleep and amuse themselves and wait for summer to come again.

This is the situation from November to June. The illustration of the book with half tones leaves nothing to be desired. The index is fairly adequate, but the map is a rough black-and-white sketch, without even a scale of miles. The book may be commended without reserve to all who are seeking information about Alaska.

Auf Alexanders des Grossen Pfaden. Eine Reise Durch Kleinasien. Von A. Janke. viii and 186 pp. 20 Illustrations from photographs, and 6 Plans from the surveys of W. v. Marées. Weidmannsche Buchhandlung, Berlin, 1904. (Price, M. 7.)

German army officers have been especially prominent in recent years in the exploration of Greece and Asia Minor. In 1902 Captain Janke, with three lieutenants, visited the ancient battlefields of Issus and the Granicus River, now known as Bigha Tschai. The attempt was made to work out from the ancient accounts of Alexander's battles with the Persians, and from studies of the topography, the sites of the battlefields, the dispositions of the contending forces, and the routes they followed through the country. Captain Janke made a diligent study of all the literature that might help his work. He gives important reasons for his belief that he has fixed the position of the battlefields of Issus and the Granicus; and, in addition to his researches in the path of Alexander, he explored, as far as possible, the valley of the Kor-kun-Su River, and followed a new route through the steppe between Eregli and Konia to the north of the route that appears on the Kiepert map.

Aus Papuas Kulturmorgen. Südsee-Erinnerungen. Von Stefan von Kotze. 227 pp. F. Fontane & Co., Berlin, 1905. (Price, M. 3.)

Mr. von Kotze has drawn upon his own experiences for this lively account of the beginnings of the German occupancy of New Guinea. He writes with humour, and also with biting sarcasm, of his recollections of those troublous days when the New Guinea Company was getting a foothold on the coast of Kaiser Wilhelm Land. The unlooked-for mishaps, the unexpected situations, the stupidity and blundering that marked much of everyday history, the demeanour of the natives, and the poor quality of a great deal of the scientific work done, are sketched with a lively pen. Dr. Reinecke, reviewing the book for the *Literatur Bericht* of *Petermanns Mitteilungen* (No. 280, 1906), says that many of the critical observations of the author are, unfortunately, only too true.

Bibliotheca Geographica. Herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Band XI. Jahrgang 1902. W. H. Kuhl, Berlin, 1905.

The present issue of this invaluable annual has advanced another stage towards all attainable completeness. It contains over 10,000 titles in 20 languages, filling 531 pages. All geographical workers appreciate the great helpfulness of this laborious and very careful compilation, and it is gratifying to read in Mr. Baschin's preface that he expects further to reduce the long gap between the bibliographical year represented in each volume and the year of publication. The volume for 1903 is now so far advanced that it is expected to appear in a short time.

Great Britain. Handbook for Travellers. By K. Baedeker. (6th Edition, revised and augmented.) lxvi and 606 pp., 22 Maps, 58 Plans, a Panorama, and Index. Karl Baedeker, Leipzig, 1906. (Price, M. 10.)

The latest revision of the English edition of this well-known handbook, which in all respects has been brought down to date. It contains four new maps and nineteen new plans.

Conférences de Géologie. Par Marcellin Boule. 223 pp., Maps, Illustrations, and Index. Masson & Co., Paris, 1904. (Price, frs. 2.50.)

This book is in the "Cours Élémentaire d'Histoire Naturelle" and is intended for elementary classes in geology. There is no doubt that it is excellently adapted for this purpose. What it presents is the elements of geology simply told and with many interesting explanations. The physical world and its forms of life are described in some of the aspects which they presented during the several geological eras. The illustrations are especially excellent and very helpful to the text. At the end of the volume is a fine geological map of France in colours.

The Junior Geography. By A. J. Herbertson. 288 pp. and 166 black-and-white maps. The Clarendon Press, Oxford, 1905.

Herbertson's Junior Geography, being Vol. II of the Oxford Geographies, is devoted to the " Regional Geography necessary for the Oxford Junior Local Examinations." As would be expected, the larger attention is given to Europe, that continent being treated in 165 pages. The remaining space is devoted to a treatment of the other continents in a brief but generally effective way.

The treatment in every case is causal in order, the physical conditions being first considered as a basis for the life and economic conditions.

For a teacher who would have a handy reference volume for material on Europe to supplement her class work, no better book could be recommended. The diagrammatic maps are extremely effective, and are constantly referred to in the text, so that the reader is obliged to base his study on the maps—a very strong point in favour of the book.

An excellent index completes a most usable volume, attractive in form and content.

R. E. D.

Makedonische Fahrten. Von Adolf Struck. 1.—Chalkidike. With 12 illustrations, 3 sketch maps in the text, and a route map. Heft 4, in the series, Zur Kunde der Balkanhalbinsel Reisen und Beobachtungen. A. Hartleben's Verlag, Vienna and Leipzig, 1906. (Price, M. 2.25,)

The present monograph only confirms the opinion, previously expressed in the BULLETIN, that this series is a very desirable addition to our limited literature on the Balkans. Mr. Struck travelled in Macedonia, of which the ancient Chalcidice forms the large southern peninsula, between 1898 and 1903, primarily for antiquarian research. His routes in Chalcidice (1901 and 1903) skirted the coasts of the main peninsula and two of its southern extensions, and also penetrated through the interior. His comprehensive paper is a description of the geography and people of the country and their present conditions. A good map accompanies the work, and the half-tone pictures vividly illustrate the topographic forms, the villages, and inhabitants.

In Africa. Victoria Nyanza e Benadir. By Cap. E. A. d'Albertis. 162 pp., 185 Illustrations from photographs, 2 Tables, 3 Maps, and Index. Istituto Italiano d'Arti Grafiche, Bergamo, 1906. (Price, L. 7.)

This book appears in the *Serie Viaggi* of the "Collezione di Monografie Illustrate." In our present knowledge of tropical Africa such works are of real service, because their graphic photographs and the information they give about newly-developing regions give us clearer ideas of the local geography and place us more closely in touch with the present phases of progress. Such fine photographs as that of Ripon Falls, where the Nile has its birth, of the wooded shores of Victoria Nyanza, with a steamer at anchor off the shore, of Waganda bringing canoe loads of bananas and other fruit to the markets, and scenes along the line of the Uganda Railway, are very interesting, because they are novel and informing. The pictures include excellent panoramas of the entire water front of some of the coastal and island cities, as Zanzibar, Brava, and Mombasa. The letterpress is a simply written description of the regions, towns, and peoples visited. A picture of pathetic interest shows the wreck of the little steamer in which the explorer von der Decken was ascending the unknown Jub River when he was killed by the fanatical natives in 1865. The deck, barely out of the water, is covered with vegetation, which has clambered half way up the smokestack.

Europa. Zweite Auflage. Von Professor Dr. Alfred Philippson. xii and 761 pp. 14 coloured Maps, 22 Tables, Coloured Plates, 144 other Illustrations, and small maps in the text. In the series, "Allgemeine Länderkunde," Edited by Prof. Dr. Wilhelm Sievers. Bibliographisches Institut, Leipzig and Vienna, 1906. (Price, M. 17.)

This volume offers probably the best description of Europe in similar compass that has yet appeared. It differs largely from the first edition. The chapters on the general geography and topography have been entirely rewritten, the general survey of the continent has been extended, larger attention has been given to the industrial, cultural, and politico-geographical conditions of the several countries, and the pictures are more numerous and more of them are reproduced from photographs. The fact that Professor Alfred Philippson had charge of the preparation of the book, assisted to some extent by Professor Ludwig Neumann, is an assurance of skilful selection of material and scholarly treatment which will not be at all impaired by careful perusal.

The volume opens with a general review of the continent, the special reasons for its importance, its position, boundaries, size, and articulations, its topography, hydrography, climates, flora and fauna, the population, with their religions, states, culture, industry, settlements, and density; and the means of communication in Europe, and with other parts of the world, the whole filling 135 pp.

The second section (249 pp.) describes the territory occupied by the mountain systems of southern Europe with their high or low plains and their populations and development, thus establishing, in this treatment of the subject, the close relations between man and his environment. The six subdivisions of this section are the Alpine Lands, the Carpathian Lands, the Balkan peninsula, the Greek peninsula and its islands, Italy, and the Iberian peninsula.

The third section (244 pp.) is similarly devoted to the farming lands (Schollenland) of Northwest Europe, and section 4 (70 pp.) to the Russia-Scandinavian tablelands with their surmounting mountains and the Russian low plain. The volume closes with a comprehensive bibliography of the most important literature relating to Europe, and an excellent index. The large coloured maps are admirable and have been brought down to date. Our teachers who read German will find this book full of apposite and suggestive material for the amplification of class-room topics, and the classified bibliography will form a comprehensive and convenient guide to the most authoritative publications on all phases of the geography of Europe.

In Northern Seas. Mr. Alfred Searcy's Experiences on the North Coast of Australia. By E. Whitington. Adelaide, 1905.

Newspaper articles reprinted in a pamphlet and relating to the adventures and observations of Mr. Searcy during his fourteen years in the Government service at Port Darwin and other places on the northern coast of Australia. The people of South Australia are particularly interested in the prospects of their Northern Territory, as the coming completion of the transcontinental railway is expected to give an impetus, at no distant day, to the development of tropical agriculture and the pastoral and mineral industries in that region. Mr. Searcy's descriptions of the natural scenery and fauna of this remarkable country are said to be accurate, and the attractions of the land, as he presents them, are declared by those who have been there to be all that he describes. There are a considerable number of characteristic pictures. The pamphlet suffers somewhat from the diffuseness of the newspaper style.

Dans le Bled es Siba. Explorations au Maroc. Par Louis Gentil. xv and 364 pp., Illustrations, Appendix, and Index. Masson & Co., Paris, 1906. (Price, $2.40.)

Mr. Gentil was the geologist of the latest Segonzac expedition in Morocco. It was a fruitful expedition in spite of the brief captivity of its leader in the hands of professional pillagers. Each member of the party had his own work, and Gentil's observations on geology and topography were made in the company only of his personal attendants. He made a short expedition between Tangier and Tetuan and four separate journeys in the western part of the main Atlas and the coast region south of Mogador. The last journey, which involved considerable hardship, led south from Demnat across the Atlas range, during the passage of which Gentil discovered the first fossils by which it will be possible to determine the age of the ancient axis of the range in these parts. On the southern slopes he also met with fossils of a fine carboniferous fauna. Throughout his journey he paid large attention to physiography, and his book treats largely of the genesis of the land-forms.

A geologist and geographer of attainments, Gentil entered a prolific field for pioneer scientific observation, and he was well qualified to observe and describe. The result is an exceptionally good book, and one of the best recent works of exploration. The publishers have produced it in a most excellent manner. The beautiful half-tone illustrations give a very large number of graphic views of the physiographical aspects along the explorer's routes. Unfortunately, not even a sketch map has been provided to show his routes.

Some Facts about the Weather. By William Marriott. 8vo. London, 1906. pp. 32.

A "popular meteorological handbook," to quote part of the title, prepared by the assistant secretary of the Royal Meteorological Society, published at the low price of sixpence. We take it that this little volume covers about the ground of the popular lectures on meteorology given under the auspices of the Royal Meteorological Society at agricultural and other exhibitions, schools, etc., during the past few months. Some information is given regarding the more important meteorological phenomena, and a few illustrations make the text clearer. R. DeC. W.

The Connecticut River and the Valley of the Connecticut. Historical and descriptive. By Edwin M. Bacon. xx and 487 pp. 60 Illustrations from Photographs, Index and Map. G. P. Putnam's Sons, New York, 1906. (Price, $3.50.)

From a geographical point of view, this informing volume seems open to some criticism, not because the geography of the Connecticut River and its valley is not set forth in considerable detail, and in a manner calculated to interest the general reader, but because the geographical section is reserved for the last 118 pages of the book. The geography of the valley was one of the most important influences in shaping the history of its settlement and development. The seceders from the Boston or Bay Colony partly explain their removal to Connecticut by the facts (1) that there was lack of accommodation for their cattle, the settlements being so close together that they were not able to maintain their minister or receive any more of their friends; and (2) "the fruitfulness and commodiousness of Connecticut." It was the lack of land around Boston and the plenitude and the good quality of it in the Connecticut valley that supplied two of the three reasons by which the settlers justified their removal.

Geography is usually recognized by writers of to-day as one of the most important bases of history. The tendency now is to give full prominence to all the influences exerted by geographical environment upon the development of every form of life and the shaping of human activity. The pleasure of reading the story of the Connecticut River and its valley might have been enhanced if the introductory chapters had made clearer the physical conditions under which this history was evolved and the author had called attention, here and there, as might have been done without tediousness, to the continual interaction between human activity and geographical environment that largely made this history and shaped the destinies of the teeming valley.

The history of the valley from the discovery of the river by Adriaen Block, the Dutch navigator, in 1614, to the close of the eighteenth century fills 300 pages, or about three-fifths of the book. It is a stirring and well-told recital of many phases of life of which one of the fairest valleys of the country was the scene—the Indian and colonial wars, the pioneer development of improvements and industries, the evolution of democratic government, and the planting of more colleges and higher schools than are to be found on any other river of the world. The author consulted many original authorities, and, as the result of this research, he has given new readings of popular history in a number of instances.

The second part of the book deals admirably with the development of transportation on the river, and from this material a few facts may be condensed here:

> Navigation by white men was first confined to the sixty miles between the river mouth and the head of tide water below Enfield Falls. After the English colonists arrived, the flat boat or scow, which could run the Enfield rapids at high water, was contrived, and then navigation was extended to Springfield. Above that point commerce was carried on the river between the falls through the Massachusetts Reach by canoes, or flat boats, till the middle of the eighteenth century. The far northern reaches were navigated by the hunter, trapper, and soldier, long before that time. The earliest traffic was in furs, skins, and hemp, brought in by the Indians. As settlements advanced above the Massachusetts line, larger flat boats were operated between the various falls, freight being unloaded at the foot of each fall, and transported around it by teams. The river was the first (1791) in America to be improved by canals and locks around the falls (1791). The first steamboats in regular service on the lower river began to ply about 1824.

In the topographical section the author gives not only a summary of the geological and physiographical features but also a pen-picture in detail of the river from its headwaters to Long Island Sound. He quotes the tribute that Timothy Dwight paid to the greatest of New England streams when he wrote in part:

> This stream may perhaps with more propriety than any other in the world be named the Beautiful River. From Stuart to the Sound it uniformly maintains this character. The purity, salubrity, and sweetness of its waters; the frequency and elegance of its meanders; its absolute freedom from aquatic vegetables; the uncommon and universal beauty of its banks, here a smooth and winding beach, there covered with rich verdure, now fringed with bushes, now covered with lofty trees, and now formed by the intruding hill, the rude bluff and the shaggy mountain, are objects which no traveller can thoroughly describe and no reader can adequately imagine.

The author is to be congratulated upon this result of his painstaking research and literary effort. He has well described and adequately told the story of the River Beautiful throughout its 350 miles from mountain to sea. Nothing has been left undone by the publishers to make the large book attractive. It is unexceptionable in paper, typography, and illustrations. Sized paper is reserved for the full-page photographs, so that the eye is not constantly affronted with glaze, and the book is not so heavy that handling it is a kind of muscular exercise which should be reserved for athletics.

Die Herero. Ein Beitrag zur Landes-, Volks-, und Missionskunde. Von Missionar I. Irle. viii and 352 pp. 56 Illustrations, Map and Index. C. Bertelsmann, Gütersloh, 1906. (Price, M. 5.)

The author was engaged in missionary work among the Herero in German Southwest Africa for thirty-four years. The veteran pioneer wrote this careful and full account of the country and people in great sadness of heart, because many of the fruits of his hard labours for a generation were swept away by the recent war, which resulted in the terrible punishment of the natives. The book is written with conservative judgment and fulness of detail. About a tenth of it is given to an excellent description of the geographical features of the land; the second section to the Herero, in which their history, character, speech, and religion are described, and special attention is given to their family life, social condition, arts, and customs. The Bergdamara and Bushmen, the trade, the wars, and German rule are described in the same section, and the concluding third of the book is devoted to missionary work among the Herero.

Erdkunde fur höhere Lehranstalten. Von Dr. Adolf Pahde. (III Teil: Mittelstufe, zweites Stück.) Second edition. v and 172 pp., 14 Illustrations, and Index.

This part of Dr. Pahde's text-book deals with the oceans and all the continents, excepting Europe, and there is a special section on the German colonies. It is more full of information than even our own text-books. A notable and commendable feature is the insistence that school atlases shall be used in connection with the text. There are very few pages on which the student is not referred to one or another of the leading German school atlases to study the cartographic delineation of facts given in the text.

THE HANDY WORLD ATLAS AND GAZETTEER. 120 Maps, and a Gazetteer. Frederick Warne & Co., New York (not dated). (Price, 40c.)

A pocket atlas, of which the maps were made by Bartholomew, Edinburgh, and are good for the small scale. The European countries, and especially Great Britain and Ireland, have many more pages than any other lands, showing that the atlas was primarily intended for British use. Six of the small plates are, however, given to the United States, and New York and Chicago and the regions around them are given on a comparatively large scale. Six Mercator charts show the distribution of the most important commercial products, and there are also physical, climatic, and vegetation maps. The place-names on the maps are sufficiently numerous and important to make the little book (which may easily be carried in a pocket) frequently useful for ordinary purposes. The Gazetteer devotes one line to each of about 10,000 of the most important places of the world. The Polar charts are sufficiently recent to show the latest explorations in the polar regions.

Baluchistan. By Colonel C. E. Yate. Read on February 14, 1906, before the Central Asian Society. 39 pp., including discussion. London, 1906.

This is a description, chiefly administrative and political, of Baluchistan, of which Col. Yate was Chief Commissioner from 1900 to 1904. Baluchistan is not much less than three times as large as New York State; and as it is a factor in questions relating to India, Afghanistan, Persia, and Russia, it will be profitable to present here some of the authoritative facts given in Col. Yate's paper.

Only the northeastern part of the country, or a little more than one-third of the whole, is directly administered by the British Government. This region is divided into the five districts of Zhob, Loralai, Sibi, Quetta-Peshin, and Chagai, and it is governed by five district officers with four assistants, or nine British officers, all told. In view of the importance of Baluchistan both in a political and military sense, the wildness of the tribesmen and the continual fights, disputes, and disturbances, Col. Yate believes that the British element in the administration is not sufficiently strong.

The Government of India is endeavouring to stimulate education among the upper classes of the province. It has given special grants for the construction of a boarding-house to be attached to the Sandeman High School at Quetta for the accommodation of the sons of Sirdars and headsmen who may be sent there for their education; also for the construction of a library and museum which has been erected at Quetta. At the suggestion of Col. Yate, the chiefs, officials, and people of Sibi erected a large hall in 1902 in memory of Queen Victoria. Thus Baluchistan is gradually becoming provided with public buildings. All this relates to the northern part of the province, which may be called British Baluchistan.

The southern and larger part of the province is all native territory, and in this region, nearly 80,000 square miles in extent, the British have only one political agent with two assistants. The Khan of Kalat is the nominal ruler of the country, but, after all, he is only *primus inter pares* among all the Brahui and Baluch Sirdars of whom the Kalat confederacy is composed. The power of the tribal chiefs has increased, and the power of the Khan, as the leading factor in the country, is no longer what it formerly was.

The Baluchis and Brahuis of Southern Baluchistan are large camel and sheep owners, and are nomads and graziers more than cultivators. Col. Yate says that camel registration for possible use in war has been successful beyond expectations, and arrangements have been completed for the enlistment of many camel corps both from Pathans and Baluchis, in case of necessity. A complete camel corps was enlisted and sent to Somaliland, two years ago, within ten days, and many such corps could be enlisted and sent off to any part of the world with equal celerity. Many of the camelmen in Western Australia are from Baluchistan.

Col. Yate discusses at length the relations between Persia and Baluchistan, and considers it unfortunate that Persia was permitted to annex what is now known as Persian Baluchistan, over which the Government is able to exercise little control, so that the Indian Government has been put to the trouble and expense of sending troops into this lawless region to do work that the Persians should do for themselves. He also deals with the question of Persian and Russian railroads.

Rome. A Practical Guide to Rome and its Environs, By Eustace Reynolds-Ball. viii and 256 pp., 8 illustrations in colour, plans of the Forum, Vatican and Rome. Bibliography and Index. The Macmillan Company, New York, 1906. (Price, $1.00.)

This book differs in some respects from most guide-books. It is discouraging to the hurried tourist who has only a few weeks to spare to find how thinly he must skim over the surface of things in Rome, though it is richer than any other city in the world in objects of archæological, historical, artistic and religious interest. This book is especially planned to help tourists who wish to get the most profit and enjoyment that is possible in a few weeks' stay. It does not neglect the interests of the more leisurely traveller, but the chief mission of the book seems to be to convince the person who must catch his steamer that he may see, enjoy, and learn much if he will omit everything but the best and keep mainly to that which interests him most, whether it be antiquities, art, architecture, or churches.

In the first place, the book tries to save time by giving unusually full and precise details on practical matters, such as routes, hotels, etc., condensed into 22 pp. of small type. The chapter on hints for sight-seeing concludes with a plan for "doing" Rome in a fortnight, in which the places and monuments that must not be omitted if the stay is only for a week are in bold type. Then follow 217 pp. on the sights of the Eternal City classified in sections as "Ancient and Mediæval Rome," "Renaissance Rome," and "Ecclesiastical Rome," with additional chapters on excursions, the residential parts of the city, etc. The method—in the Forum, for example—is to call attention only to the more important or best-preserved monuments. The pictures in colours by Alberto Pisa are striking, and the map (in pocket) shows all important features numbered with reference to a list in the margin.

Baku. An Eventful History. By J. D. Henry. xvi and 256 pp., 31 Illustrations, Map and Appendix. Archibald Constable & Co., Ltd., London, 1906.

A small area around Baku is the greatest single centre of petroleum production in the world. The magnitude and importance of these Russian oil fields have long been known, and Mr. Henry, who, from his intimate acquaintance with the petroleum industry, is well qualified for the task, has rendered a service by describing the industry as it exists to-day. He sums up the reasons for believing the Baku oil enterprises will have far larger expansion. He supplements and brings down to date the vivid description of the Baku oil industry written by the late Charles Marvin twenty years ago.

The book gives the history of the city and its industry, describes the great spouting wells, with new facts concerning the later history of these phenomena, records fresh information about men and methods at the oil fields and in the refineries, and gives a long account of the recent massacres and destruction of property which have somewhat arrested the progress of the Caucasian oil business.

But Mr. Henry has the greatest faith in the future of these oil fields. He writes:

> In no part of the world have I seen an oil region the compeer of these old and famous fields at Baku, an oil city that can equal in wealth this metropolis of the Caucasus, or a body of oil men who surpass in energy, enterprise, or business capacity those who are at the head of the industry in Baku.

Some of the geologists appear to have been seriously wrong in their calculations. Professor Abich predicted that oil would not be found at a greater depth than 60 or 70 feet, and that the introduction of steam drilling would not be beneficial to Baku. Trautschold, who visited Baku in 1873, was confident that oil of commercial value would not be struck below 200 feet and that the oil would decline in value as the drill went below 140 feet. The most prolific wells of to-day, however, are between 1,500 and 2,000 feet, and the hand-dug wells, favoured by Abich, were discarded as far back as 1878. The most productive wells are at Bibi-Eibat, which, though numbering only 222, or about a tenth of the wells in the peninsula, are yielding nearly a third of the total production.

In Mr. Henry's opinion there will be an early expansion of the oil fields of Russia. New fields are being opened on every hand. The industry is already recovering from the recent terrible events, when so much property was destroyed and hundreds of Armenians were ruthlessly butchered by the Tartars. The work of rebuilding the derricks, cleaning out the wells, and erecting drilling and pumping machinery is being pushed with all possible speed. An interesting chapter is given to Batoum, the world's largest shipping port for oil; and the trade in the Russian commodity is fully treated. This is a good and useful book.

Bedeutung und Aussprache der wichtigsten schulgeographischen Namen. Von Dr. A. Wollemann. 68 pp. Wilhelm Scholz, Braunschweig, 1905. (Price, M. 1.)

This pamphlet defines about 2,300 of the more common and important geographical names of peoples and nations, as well as places, rivers, terms used in physical geography, etc. In his short and sensible introduction Dr. Wolleman shows once more how illogical it is that the name of a country or a city should change with the language in which it is written. How much better, he says, if *Deutschland* were the universally accepted name for *Germany* and *Milano* for *Milan!* He does not labour this point, and that is well, for the obstacle in the way of uniform usage is the existence of different languages; an illogical, but a human condition which will last as long as the world.

The arrangement of the names is alphabetical under each country or region of Europe, and in one alphabet each under Asia, Africa, Australia, and other heads.

Dr. Wolleman says of San Francisco:

> Originally named after the English navigator Sir Francis Drake, who anchored here in 1579.

Prof. George Davidson, of the United States Coast and Geodetic Survey, read before the California Historical Society in 1889 a paper setting forth his conclusion, after many years' study and personal examination of the coast, that Drake never saw San Francisco Bay. The paper was published in 1890.

The city was undoubtedly named after St. Francis of Assisi.

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THE MOUNTAINS OF SOUTHERNMOST AFRICA.

BY

W. M. DAVIS.

The British Association in South Africa.—In August and September, 1905, when the British Association for the Advancement of Science held its meeting in the Colonies of South Africa, I had opportunity as one of the guests of the Association to see something of the chief physiographic features of the region we traversed; and as our excursions were always guided by local experts, for whose competence we gained the highest respect, it was possible for us, even in the brief period of thirty-three days between arriving at Cape Town and sailing from Beira (Portuguese East Africa), to gain a good general understanding of several leading problems. We were much aided in this by the excellent books lately published on the geology of the Southern Colonies—one by A. W. Rogers, Director of the Geological Survey of Cape Colony, on the district under his charge; the other by Messrs. Hatch and Corstorphine on the "Geology of South Africa;" as well as by the excellent handbook, "Science in South Africa," prepared by various writers especially for the Association meeting. It is my desire to present here a brief statement concerning one of the most significant and well defined of the physiographic areas that we traversed—namely, the east-and-west mountain system, which occupies the southernmost border of Africa. It is true that we passed through only the western end of these mountains; but their structure seems to be so regular that a fair appreciation of the whole may be acquired from the study of this characteristic sample. No name appears to be current for this mountain system; it will be here referred to under the name of the Cape Colony ranges.

The Cape Colony Ranges.—The ranges of this mountain system occupy the southern border of South Africa for a width of sixty or eighty miles and a length of 350 or 400 miles. (See map, Fig. 13.) They include a number of sub-parallel, east-and-west ridges,

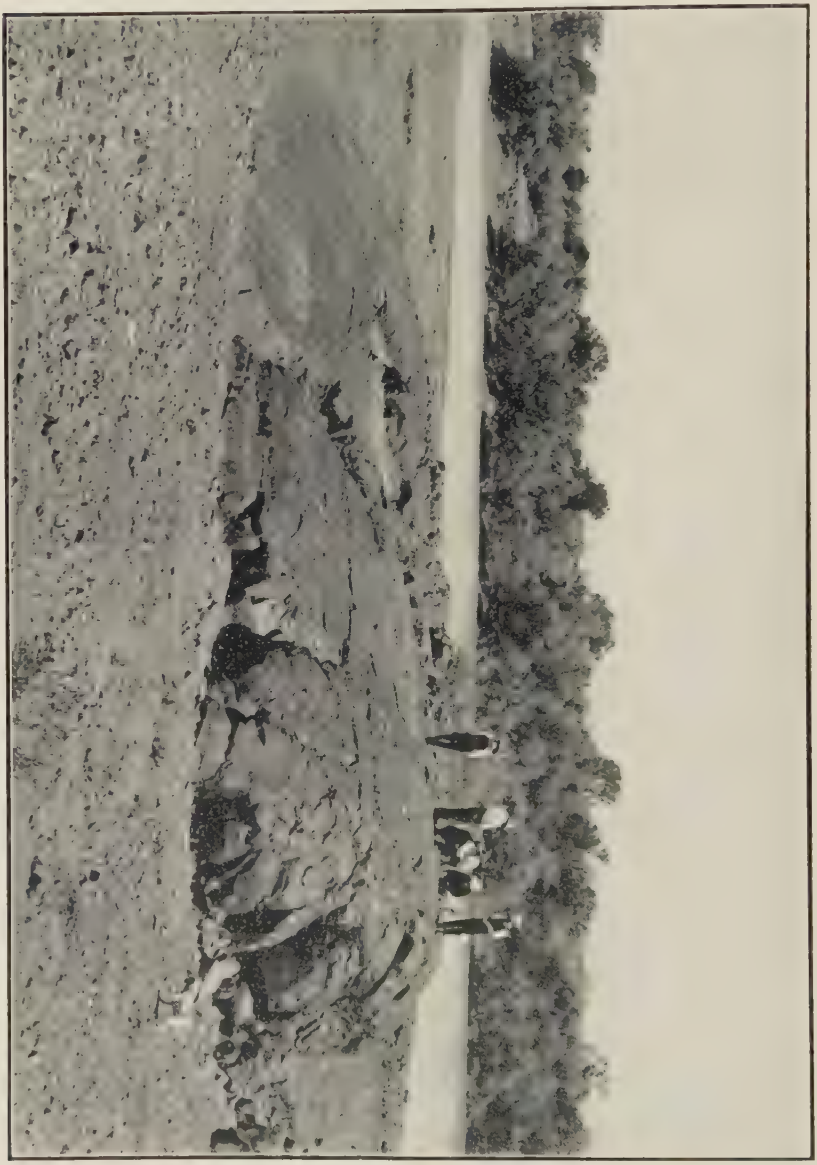

FIG. 1.—A LEDGE OF DIABASE, ON THE VAAL RIVER, NEAR KIMBERLEY, ROUNDED BY DWYKA (PERMIAN) GLACIATION.

separated by longitudinal valleys. Near the southwestern corner of the continent the east-and-west ridges are replaced by narrower and less continuous north-and-south ridges, with broad and frequently confluent lowlands between them. Table mountain range is one of the north-and-south group, with Cape Town at its northern end and Cape of Good Hope at its southern end; it seems as if this range might have been an island but for a broad belt of sandy flats on its eastern side, with Table bay on the north and False bay on the south, by which it is attached to the mainland. It is a matter of interest to note that Ras Hafun, a small peninsula of Somaliland, which we saw on the voyage home, and which instead of Cape Guardafui (as usually stated) makes the easternmost point of Africa, is another example of the Gibraltar-like tied-on islands.

It is significant that the southern coast of Africa is not parallel to the ridges of its mountain system. From Cape Hanglip, which encloses False bay on the east, to Cape Agulhas, the coast trends southeast, breaking irregularly across several short ridges. Cape Agulhas, making the southernmost point of the continent, seems to be but a short fragment of one of the east-and-west ridges. Then, turning eastward, Cape Agulhas is seen to be the first one of six east-and-west ridges which are cut off by the oblique east-northeast trend of the southern coast, with the result of making a series of northward offsets in the shore-line as each ridge is passed. We were told that these offsets were just so many disappointments to the early navigators, who thought that the eastern coast of Africa would be reached as each offset was rounded, and who had repeatedly to turn eastward again after making a little northing, before the homeward half of their circumnavigation was well begun.

The manner in which the successive ridges end in the sea at the coastwise offsets leaves no doubt that the present Cape Colony ranges are only a large remnant of the whole mountain system that was once formed there. The rest of the system has been consumed by the sea, or drowned beneath it by depression.

Comparison of the Cape Colony Ranges and the Alleghenies.—The Cape Colony ranges present a number of features that are of special interest to American geologists and geographers, because of the singularly faithful recurrence far away in the other hemisphere of features familiar to us at home in the Allegheny mountains of Pennsylvania and Virginia. The strata involved in both cases are Paleozoic, but include in South Africa also some Mesozoic formations, and were originally spread out in layers of much uniformity horizontally, but of marked diversity vertically. In South Africa, the strata include the heavy Table mountain sandstones, 4,000 or 5,000 feet thick, practically barren of fossils and supposed to be of non-marine origin; the Bokkeveld ("Goat-pasture") series, about 2,500 feet thick, containing marine Devonian fossils; and the Witteberg quartzitic sandstones, with some shaly sandstones, 2,500 feet thick, practically barren of fossils and possibly of non-marine origin. These three formations, 10,000 feet in total thickness, are grouped together to constitute the Cape system. The floor on which this system rests is well seen in the Table mountain range, in the neighbourhood of Cape Town, where it is found to be an ancient peneplain, truncating the greatly-disturbed Malmesbury slates and intrusive granites, supposed to be of Archæan date. The Cape system is followed by the Karroo system, apparently 20,000 feet in total thickness: the first member is the famous Dwyka glacial formation, which lies in part of its area unconformably on well-glaciated ledges of older rocks (Fig. 1), and elsewhere conformably on the Witteberg shales; where best developed, it consists of interbedded sheets of consolidated till (for which Penck has proposed the name of tillite) and well-stratified shales, to a thickness of a good 1,000 feet; this being followed by the Ecca, Beaufort, and Stormberg formations, containing coal beds and fossils of land animals, and thus indicating a prevalence of continental conditions in the Karroo as well as in the Cape system. It is true that continental formations are exceptional in the Appalachians; but there, as well as in South Africa, the strata which were later crushed into mountain folds were deposited on what seems to have been a peneplain of still older rocks; and in both cases the great thickness of the accumulated strata was made possible by the slow depression of the area of deposition. It is well to bear in mind, when deformations of the earth's crust are under consideration, that the deep burial of old peneplains like those here concerned involves the down-sinking of a crustal surface from near sea-level to a considerable depth.

In the Appalachians, as well as in South Africa, forces of compression have crowded part of the area occupied by these heavy Paleozoic formations into long sub-parallel corrugations, with overturns and overthrusts directed towards what is to-day—and what has presumably long been—the continental centre; but in both regions the formations concerned were left essentially horizontal over an adjoining inner area, which constitutes the Allegheny plateau in the United States and the highland of the Veld in South Africa, as illustrated with undue regularity of structure in Fig. 2. From this it is to be inferred that the tangential thrust by which the compression and overturning were produced was in both cases directed from the region that is now the ocean towards the region that is now the land—that is, from southeast to northwest in the eastern United States, from south to north in South Africa. This analogy suggests another, for which the facts observed at present give permission without strong support—namely, that as the chief source of the sediments was on the ocean side of the existing ranges in the Appalachians, where the Paleozoic land area is recognizable in the belt of older crystalline rocks, a similar relation may have obtained in South Africa; but there the inferred older rocks are not visible now along the southern coast, and some evidence has been adduced to show that the source of the sediments lay inland to the northwest. It still, however, seems worth while to bear this analogy in mind; and all the more because the present southern coast of Africa has manifestly been much encroached upon by the sea. The existence of an ancient land in what is now the Southern Ocean is therefore an open possibility.

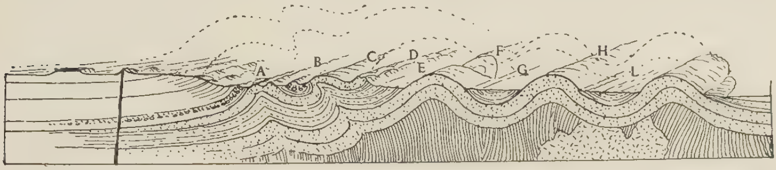

FIG. 2.—GENERALIZED SECTION ACROSS THE COLONY RANGES.

The relation of the folded belt to the unfolded highland has been explained by some South African writers as showing the work of compression against "the solid and immobile mass of the Karroo rocks" in the Veld. This gives too great credit for resistance to so much of the Karroo formation as still lies essentially horizontal. Before the folded belt was corrugated it must have looked just as solid as the Veld looks to-day. The limitation of the Cape Colony corrugations, like the limitation of the Allegheny corrugations, is better explained by the exhaustion or the satisfaction of the compressing forces, rather than by any special resistance in the area where the same strata as those of the folded belt still lie horizontal.

Two Cycles of Erosion.—Both of these mountain systems have been vastly eroded since they were formed, but the ranges that we see are in no proper sense merely the unconsumed residuals of the original uplifts. There is much reason to think that in both regions the relief due to initial deformation was practically destroyed in a long cycle of erosion, the up-arched ranges being then reduced to the small relief of a peneplain. It may be noted briefly that the best evidence for this conclusion, in so far as the Cape Colony ranges are to-day known, is found, not in their own area, but in the area of the Veld to the north. There the highland plains (Fig. 3) are demonstrably not plains of original construction, but plains of penultimate or even ultimate degradation; for they are frequently surmounted by residual hills and mesas of more resistant rocks, whose former greater extension over the plains of to-day is undoubted. The resistant rocks are chiefly dolerites, which occur in the form of dikes and sheets over a large part of the highland area; where heaviest the dolerite sheets form the Stormberg and Drakensberg mountains, which now constitute part of the divide between the long and leisurely westward descent of the Orange river headwaters and the more rapid southeastward descent of shorter streams to the Indian Ocean.

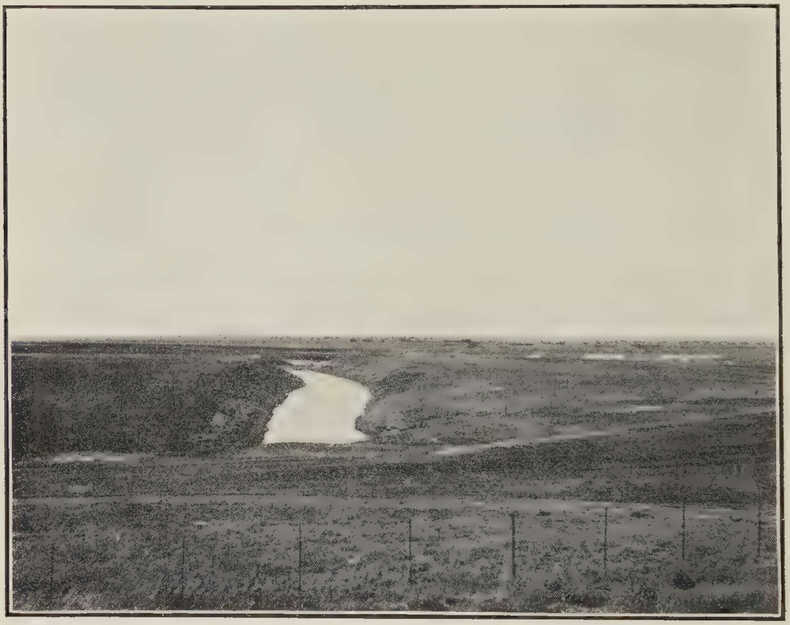

FIG. 3.—THE VELD.

The openness of the greatest part of the Veld has had a marked influence on the settlement of the country. In the earliest days it made exploration by the vanguard, "the frontiersmen," of the

Boers very easy, after once the ascent of the highland was accomplished; shortly afterward, at the time of the Great Trek in 1836, it permitted the entrance of families and, indeed, of communities, bringing all their household goods in wagons—for much of the Veld is so flat and so free from vegetation that ox-teams can draw heavy loads over it in any direction for miles together. In later years the same openness has greatly facilitated the construction of railway lines, which have now attained an important development, though the traveller must often marvel, as he does on the Great Plains of the United States, which the Veld in so many ways resembles, how it is possible to make a railway line pay where distances are so great and where people are relatively so few.

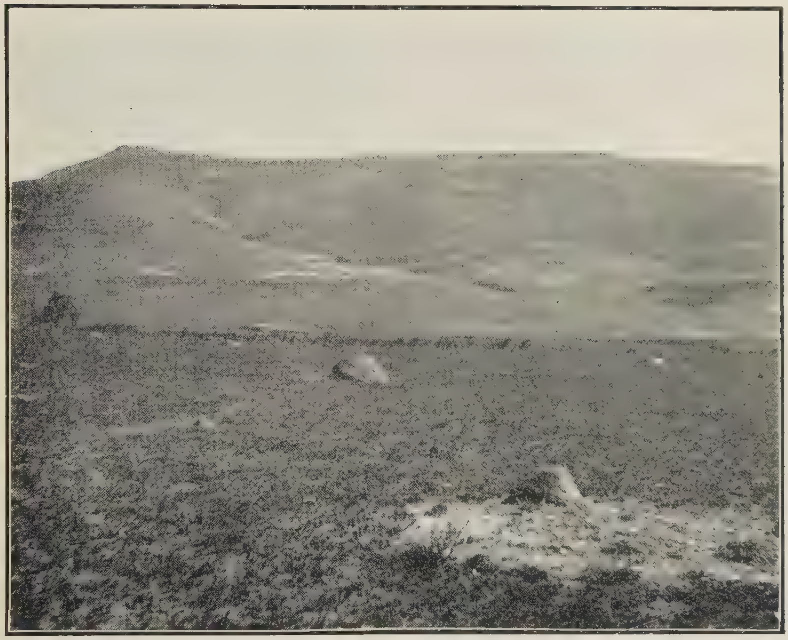

FIG. 4.—HLOBANI.

The ridges and mesas of the Veld, mostly of dolerite, are likewise of geographical significance. They are deserts, as far as human habitation is concerned, for their surface is stony and barren; but they afford excellent points of view from which routes of travel can be laid out for many miles in advance, and they have been repeatedly held as points of vantage in warfare by Zulus, Boers, and British. Some of the hills have thus become famous; witness Hlobani and

Majuba, shown in Figures 4 and 5. Where the dolerite sheets lie but little above the general level of the plain their barren, rocky surface, strewn with loose boulders of disintegration, is very unlike the smooth surface that has been worn down on the shales which underlie most of the Veld. The chief obstacle in the way of travel on the highland is presented, not so much by the ridges as by the rivers, which at time of high water are impassable except where the few bridges have been built, and which at time of low water are to be crossed by fording at some point where the high banks of the channels are sloping enough to haul a wagon.

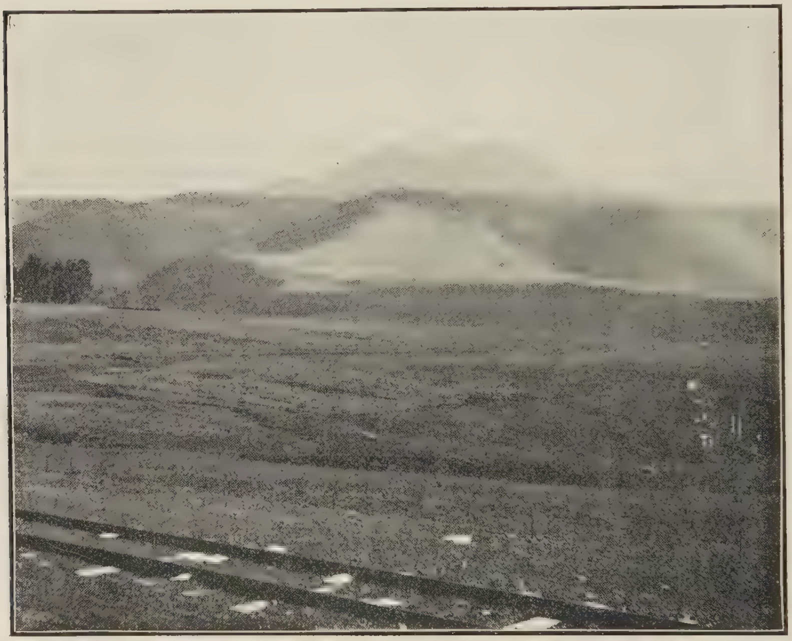

FIG. 5.—MAJUBA HILL.

It is noteworthy that the southern boundary of the area of dolerite intrusion lies a little north and closely parallel to the border of the corrugated belt, and that the date of the intrusions is about the same as that of the corrugations. It is, therefore, permissible to suppose that both the corrugation and the intrusion—or the ascent of igneous rock from its deep source—were the results of the same force, and that here as in various other regions the first cause of the ascent of igneous rock may be due to simple squeezing, however large a share of final eruption may be due to the explosive action of included gases when the ascending rock approaches the surface. In this connection it may be mentioned that in the Kimberley diamond district one of the necks occupied by the greatly-weathered peridotite or "kimberlite" has been completely excavated to a depth of over 1,500 feet (Fig. 6), with the result of showing that the necks unquestionably occupy tube-like pipes, however difficult it may be to explain their origin.

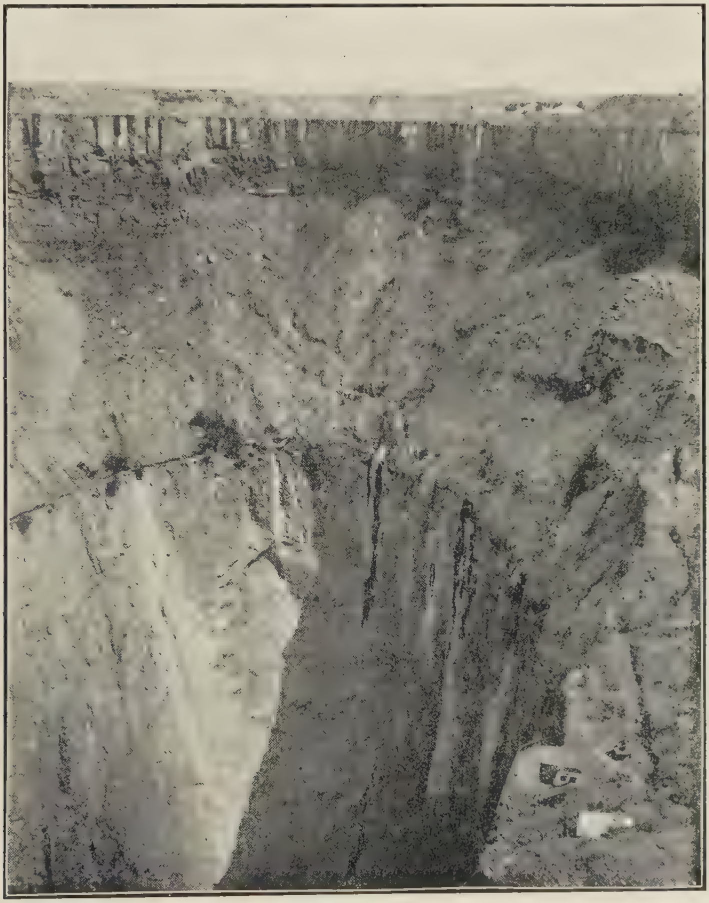

FIG. 6.—THE KIMBERLEY MINE.

Farther north, about Bulawayo in Rhodesia, the peneplain is worn down on disordered schists, locally surmounted by curious knobs of weathered granite, called Matopos (Fig. 7); they have practically the appearance of great boulder heaps. Some of the non-geological members of the excursion party suggested that the boulders might be of glacial origin; but they are without question simply decaying masses of granite. The rounded form of the boulders is due merely to the action of the weather, flaking off the corners and edges of joint blocks.

It is in the highest degree probable that the same period of time which sufficed for the great erosion of the Veld sufficed also for the wholesale destruction of the originally up-folded ranges next south. Besides this there are certain uplands, described by Schwarz and others, among the southern ranges where the surface is distinctly bevelled across the strata; and these go far to confirm the inference based on the history of the Veld.

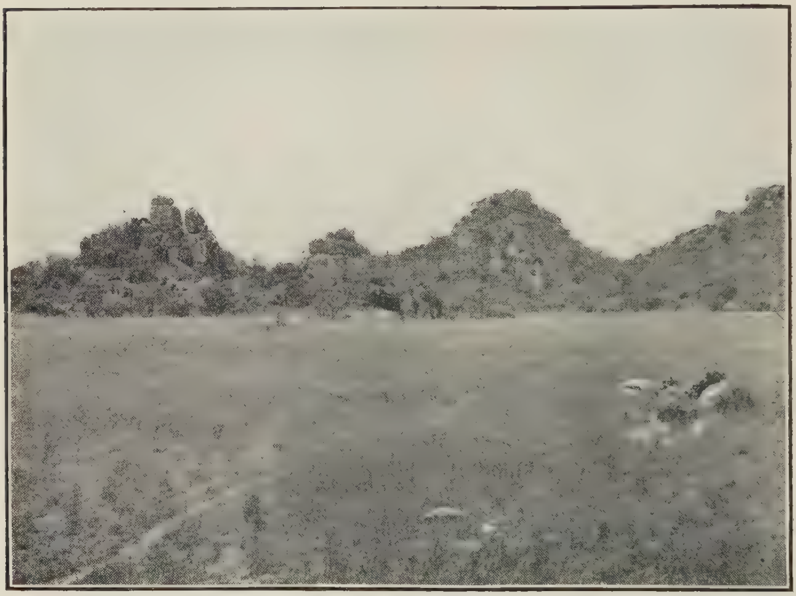

FIG. 7.—MATOPOS.

As a result of this long cycle of erosion the heavy formations of the Karroo system have been almost entirely removed from the area of the Cape Colony ranges, although they still stretch far and wide over the Veld; just as the Carboniferous strata have been largely removed from the area of the folded Appalachians, although they still stretch broadly over the adjoining area of the Allegheny plateau. The evidence of the former greater extension of the now eroded members is the same in both cases; they are believed to have stretched over most of the folded area, because they are still preserved there wherever deep synclinal folding kept them at a low level, and so prevented their removal by erosion.

Since the advanced erosion or partial peneplanation of the folded ranges took place the renewal of deep erosion shows that the land has taken a new attitude with respect to the circumjacent seas. In the case of the Appalachians it is generally agreed that the new attitude of the land was caused by a broad up-arching of the mountain belt; in the case of the certain parts of South Africa which, along with Cape Colony ranges and the highland of the Veld, are to-day suffering a deeper dissection than was once possible, it has been suggested that the new attitude of the land with respect to the sea was not the result of an uplift of the present land area, but of a depression of an adjoining area of former higher border lands. The submergence of such border lands would bring the sea closer in towards what was formerly an interior highland; and in this way the drainage of the formerly-enclosed interior highland might have been diverted to the shores of an encroaching sea. This would result in the dissection of the highland just as effectually as if it had been directly elevated. The question here outlined is more fully discussed in a paper offered to the Geological Society of America, with the conclusion that South Africa has been diminished in area by the submergence of former border lands on the east, south, and west, and that it has probably been elevated since the peneplanation of the Veld and the great erosion of the mountain belt.

However all this may be ultimately settled, the effects of the later cycle of erosion that was introduced in consequence of the new attitude of the South Africa with respect to sea-level and sea margin are of as essential importance in describing the present form of the Cape Colony ranges as in treating that of the Appalachians. In the new cycle of erosion, longitudinal valleys and lowland belts have been excavated along the bands of weaker strata, thus leaving the more resistant strata standing up in residual ridges. The ridges of both these mountain systems are, therefore, due to "circumdenudation." It gives a wrong idea to say that the ranges are "true mountains, produced by the earth's crust being thrown into upward folds from the south and west." They are certainly true mountains; but, as we shall see, they are much more the result of differential erosion than of differential elevation.

In some of the accounts of these ranges, surprise has been expressed that certain of the anticlines have not been more consumed; and it is added that "a satisfactory explanation of this question has not yet been found." Precisely the same difficulty has been felt by some observers in the Alleghenies, where certain folds are greatly eroded and others are almost intact. I venture to suggest that a sufficient explanation for this apparent difficulty is found in the conception of two cycles of erosion. All the structures, whether of strong or of weak strata, that rose effectively above the baselevel of the first cycle, have been enormously worn away; while the hard structures that lay below the earlier baselevel have not yet been much consumed by erosion in the second cycle with respect to the lower baselevel.

The Adjusted Drainage System.—There is every reason to think that the drainage of folded mountain ranges in the early stages of their history must be in greatest part consequent on the forms produced by the folding: longitudinal consequent streams should follow the synclinal troughs, and lateral consequent branches would descend to them from the anticlinal arches. Such is, in essence, still the pattern of drainage prevalent in the Jura mountains, whose erosional history is relatively simple, even though it may involve more erosion than has generally heen supposed. The ranges here considered have drainage systems of a very different kind. A notable result of the great work of erosion in both the Allegheny and the Cape Colony mountains is the development of numerous subsequent valleys which had no foreshadowing in the topography that was consequent on the original folding of the region. Subsequent valleys are those which have been formed by the headward erosion of out-growing branches of lateral consequent streams along the various belts of weak internal structure; for weak structural belts must be repeatedly laid bare on the sides of the lateral consequent valleys, as they were worn deeper and deeper into the flanks of the original anticlinal arches. As a result of all this, the relief and the drainage of these worn-down and re-dissected ranges repeatedly departs from the simple consequent pattern of early youth, and exhibits instead a peculiar adjustment of streams to weak structures and of divides to hard structures which is one of the strongest witnesses to the truth of the doctrine of uniformitarianism; for in no other imaginable manner than by the long and patient seeking of erosive processes could such an adjustment be brought about. Neither the ridges nor the valleys of to-day hold any close relation to the uplifts and (relative) depressions of the time of deformation. However definitely the relief and the drainage may have at first depended on the form originally initiated by deformation, they have slowly given way to a system of adjusted relief and drainage, in which subsequent divides and subsequent streams are of the greatest importance. Examples of ridges and valleys which illustrate these fundamental principles of mountain sculpture are well known in the Alleghenies; we saw several equally good examples among the Cape Colony ranges, and the descriptions and maps of other districts than those which we crossed lead us to believe that the whole of this far southern mountain system is thus characterized.

One of the best examples of a subsequent lowland belt that we saw was a valley south of Laingsburg which has been eroded along the relatively weak strata of the Bokkeveld series, *E* (Fig. 2), on the side of a huge anticline, while to the south the axial core of the anticline (*F*) rises in the Klein Zwartberg of resistant Table mountain sandstone; and to the north rises the Witteberg range, *D*, *C*, determined by a wrinkled monocline of hard sandstones. Another excellent example of a subsequent valley is the lowland of the Karroo, or dry country, between the innermost of the Cape Colony ridges—the Witteberg range (Fig. 8), just mentioned—and the south-facing escarpment of the Veld on the north. This low-

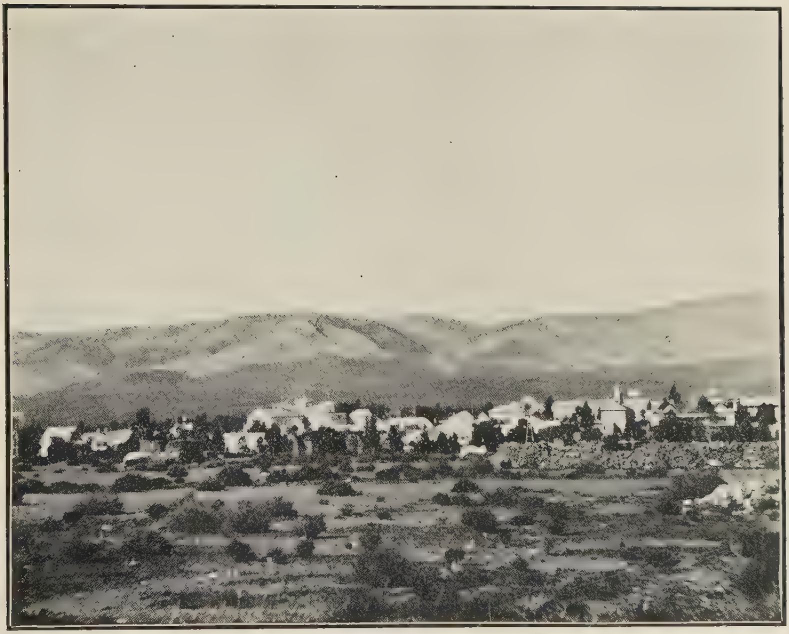

FIG. 8.—MATJESFONTEIN.

land belt, *A*, to-day followed by longitudinal streams, was originally a great north-falling slope, where the surface of deformation would have descended from the northernmost of the great mountain folds toward the relatively undisturbed area of the plateau. The counterpart of the Karroo lowland is found in Pennsylvania; one part of it is known as Bald Eagle valley, running from Tyrone to Williamsport; it has been eroded, just as the lowland belt of the Karroo has been, along the weak monoclinal strata that lie between the resistant sandstones on the flank of the innermost anticline and the still horizontal strata of the Allegheny plateau.

Consequent and Resequent Valleys.—Correlated with the development of important subsequent valleys on the flanks of the great original anticlines is the frequent abandonment of the original synclines by the chief rivers. The changes here considered are illustrated in the four stages of Fig. 9. If a deep synclinal fold is occupied by weak strata, from above which no hard strata have been eroded,it may still be followed by a good-sized river, as at *B* (Fig. 9), between anticlines of harder strata, even though much of the lateral consequent drainage originally tributary to it is now intercepted by longitudinal subsequent streams, *F*, *S*, which have been developed in weak strata that underlie the anticlinal arch; but if, as not infrequently happens, the strata now found along a synclinal axis are relatively resistant, as in Stage 3 of Fig. 9, they may stand up in a ridge of greater or less relief, at at *C*, and all the drainage of the original synclinal river may then flow by obsequent streams to neighbouring subsequent valleys, *N*, *P;* the obsequents being those branches of the subsequents that flow against the direction of the dip of the strata, and therefore opposite to the direction of the lateral consequents which they replace. Not only so: some of the streams that follow longitudinal synclinal courses in a deeply-eroded mountain range, as if they were genuine persistent consequents, are in reality of a more complicated origin. Consider an example in which the weak strata now followed by such streams—as at *D* in Stage 4 of Fig. 9—were not originally the "top of the heap," but were buried at time deformation by several thousand feet of overlying strata, some of which were of a considerable resistance. During the erosion of the region, the down-bent axial part of these resistant strata would for a time assume the form of a synclinal ridge, *C*, and the original synclinal stream would then be replaced by two subsequent streams, *N*, *P*, in neighbouring longitudinal valleys; but this stage of topographic evolution would be followed later by the complete removal of the synclinal ridge and the excavation of a new longitudinal synclinal valley on the deeper weak strata, as at *D* in Stage 4; and in this new-eroded valley the two subsequent streams, *N*, *P*, would have coalesced to form a single axial synclinal stream. A good example of this kind was seen in a small syncline in the Witteberg range south of Laingsburg (between *C* and *D*, Fig. 2), where the valley on the weak (upper) Witteberg shales is enclosed by ridges of the stronger (lower) Witteberg sandstones on either side. Various alternately hard and soft strata of the overlying Dwyka and Ecca series must have once occupied this syncline; and during their erosion the axis of the syncline has, with little doubt, alternately assumed the form of a ridge and of a valley, according as its surface was successively occupied by strong or weak strata. Indeed, a short ridge of Dwyka tillite still stands in one part of the valley, east of the point where Buffels river comes into it from a deep gorge in the enclosing Witteberg range on the north; and on either side of the little Dwyka synclinal ridge there is a subsequent monoclinal valley; but where the Dwyka tillite has been completely worn away the syncline is occupied by a single valley and drained by a single stream. Plentiful examples of this kind of stream development are known in Pennsylvania.

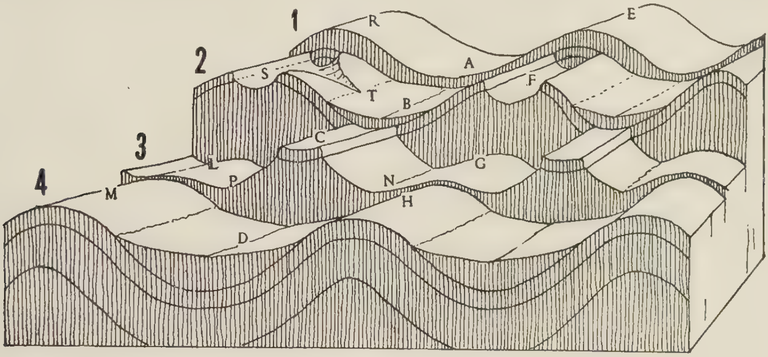

FIG. 9.—DIAGRAM OF FOUR STAGES OF EROSION IN FOLDED STRATA.

It is evidently inappropriate, in the interests of a precise terminology, to call a stream, which has after various transformations come again to flow along a synclinal axis, by the same name that is given to a stream which has never deserted such a location; nevertheless the close relation between the two streams should be expressed by an appropriate similarity of names. In view of this, I suggested a few years ago that streams which, after spontaneous development aside from an original consequent course, come again to follow it, should be called *resequent* streams. The name will have little interest for those to whom all streams are alike; but it will, I hope, serve a useful purpose in the work of those who find an elaborated terminology useful in so far as it aids to distinguish the varieties of natural facts.

Anticlinal Ridges.—The general principle that long-continued erosion will result in the survival of ridges along the belts of harder strata, while the valleys are excavated along belts of weaker strata, irrespective of the original forms produced by deformation, is well illustrated in the Cape Colony ranges; nevertheless the fact that all the chief east-and-west ridges are anticlines of Table mountain sandstone gives the impression that these ridges at least are directly consequent upon the initial folding of the region, however much the valleys may now depart from their original synclinal location. But there is good reason for thinking that the high anticlinal ridges are not immediately inherited from the original uplifts, and that they really are resequent ridges, and not consequent ridges. This will appear from a further reference to Fig. 9, where it is seen that in the erosion of a folded series of hard and soft strata, an original anticline, *E* or *R*, may be for a time converted into an anticlinal valley, *F* or *S*, of weak strata, in the floor of which may later appear the crown of another hard-rock anticline, *G* or *L*, and this may still later, when the weak strata are worn from its flanks, come to stand up in strong relief, *H* or *M*, directly underneath the lost anticlinal ridge of the original folding. Such an anticlinal ridge ought not to be called a consequent ridge, for it is not an immediate successor of the originally up-folded anticlinal ridge; but it so closely repeats the form of the original folding that it may well be called a resequent ridge. Similarly, the streams that run down its side slopes are not properly called lateral consequents. That name is appropriately given to the streams on the original folded surface —if such a surface ever existed—and to their immediate successors; but already in the second stage of erosion indicated in Fig. 9, the lateral consequents have lost their heads (except for an occasional surviving member, as at *T*, which notches the anticlinal slope and drains the axial subsequent valley, *S*; but even these survivors disappear in the later stages of erosion); in the third stage they are almost extinguished, while a new series of similar streams —lateral resequents—is beginning to be developed on the crown of the then newly-uncovered hard-rock anticlines, *G* and *L*; finally, in the fourth stage of erosion, which represents fairly well the present condition of the Cape Colony ranges, the original lateral consequents have disappeared entirely, and their places are well taken by the prolonged lateral resequents, which now join a longitudinal resequent on the axis of a resequent synclinal valley.

Klein Zwartberg, *F* (Fig. 2), appeared to be an admirable example of a resequent anticlinal ridge, as thus explained. We saw it from a knob of a monoclinal Witteberg range, *D*, across the broad subsequent lowland of Bokkeveld beds, *E*, some ten or fifteen miles wide; the crest of the great anticline of Table mountain sandstones rose in most of its visible length to a remarkably even skyline, deeply trenched at one point, where Buffels river has cut a superb Poort or notch; the bare, rocky side slopes being gulleyed to a moderate depth here and there by lateral resequent streams. It is eminently possible that an anticlinal valley, eroded on the weak Bokkeveld strata, existed directly above site of the Zwartberg during a late stage in the earlier cycle of erosion, and that ridges of Witteberg sandstone then existed over the site of the present Bokkeveld valleys.

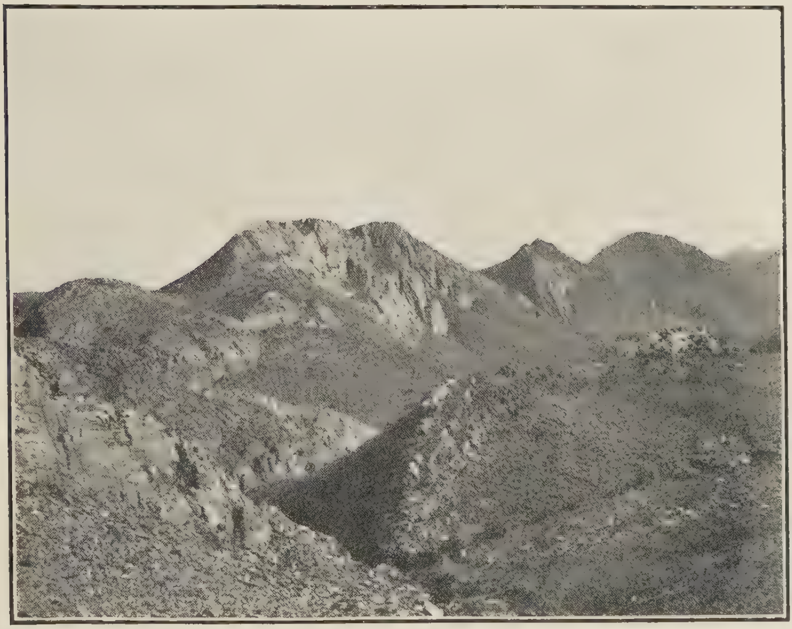

FIG. 10.—A RIDGE IN THE WITTEBERG.

As in the anticlinal ridges of Medina sandstone in the Alleghenies, for example, Jacks mountain south of the Juniata gap at

Mapleton, the evenness of the crest-line of the Klein Zwartberg need not be taken as an indication of truncation by former base-levelling; for in both these almost identical cases the evenness of the crest is simply enough explained as the result of stripping away the weak overlying strata from the top of an evenly-folded arch. It is natural, therefore, that the east-and-west Cape Colony ranges should, like the Alleghenies, be devoid of isolated and dominating peaks. Regularity of crest-line is the rule; but certain monoclinal ridges of intermediate strength, such as that of the Witteberg sandstone (Fig. 10), next north of Klein Zwartberg, are cut into knobs by obsequent ravines. Abundant examples of similar "comby ridges" are found in the monoclines of the Alleghenies.

Poorts or Watergaps.—The longitudinal ridges of Cape Colony, like the ridges of the Alleghenies, are frequently cut across by Poorts or watergaps, through which the wider longitudinal valleys —consequent, subsequent, and resequent—of the interior are drained. The Poort of Buffels river in the Klein Zwartberg and the gap of the Juniata in Jacks mountain, just mentioned, are excellent examples of this class of forms. Here we find remarkably fine illustrations of the manner in which a belt of resistant strata may maintain steep walls enclosing a narrow valley, during a stage of regional development in which the belts of weaker rocks, upstream and downstream from the gaps, are already eroded to the form of wide-open, late mature valleys, or even to the subdued forms of old age. It was interesting to find that in South Africa, as in Pennsylvania, one may still meet with the archaic explanation of such transverse gaps as sudden fractures of the ridge in which they are incised. A modified form of this old view is found in the statement: "The rivers . . . force their drainage through the ridges to the sea." The difficulty with such explanation is, not simply that there is no evidence of sudden fractures, but also that the explanation implies an erroneous understanding of the relation of the maturely open, longitudinal valleys to the narrow, transverse gaps. Explanation by fracture tacitly postulates that the only thing to explain is the gap; and thus implies that the longitudinal valleys and the ridges are, as it were, ready-made features. As a matter of fact, the longitudinal valleys are quite as much the work of erosion as the transverse gaps; and, indeed, the two unlike kinds of valleys are the work of erosion in the same period of time. In such cases the incision of the streams beneath a presumable surface of former peneplanation progressed simultaneously in their longitudinal as well as in their transverse courses all along their length, though probably at somewhat different rates in different parts. The deepening of the upstream parts of the valleys necessarily waited upon the deepening of the downstream parts; but the widening of the valleys everywhere depended only on the resistance of the rocks in which they were carved; the widening therefore varied greatly from place to place, being much more rapidly accomplished where the streams flowed along belts of weak rocks than where they flowed across belts of resistant rocks. Hence, in such cases as these, we must conceive of the inner longitudinal valley as being deepened about as fast as the transverse gaps were deepened; but while the longitudinal valleys widened with relative rapidity, the transverse gaps are still held narrow by the resistance of the rocks in which they are incised.

This explanation of the watergaps assumes that the present arrangement of longitudinal and transverse drainage had already been developed during the adjustment of the streams to the structure of the district concerned, during the cycle of erosion which ended in the production of the inferred sky-line peneplain already referred to. The location of the transverse members of such a drainage system is not easily accounted for; and no sufficient explanation for this element of the problem has yet been offered for the Cape Colony ranges.

The effect of the Cape Colony ranges in walling off one longitudinal valley or lowland belt from another was very marked. The ranges are by no means unsurmountable; but it would be difficult to construct and to maintain roads over them, and most laborious to use the roads. Hence the great importance of the watergaps as roadways, already reduced to easy grade by natural processes. Common roads and railways repeatedly run through the gaps in gaining access to the interior. The same thing is true in Pennsylvania and Virginia: if our wagon roads are here and there laid over the ridges, they are of long and toilsome ascent and of rough descent. Nearly all traffic from a valley or lowland on one side of a ridge in the Alleghenies to a corresponding district on the other side is by the way of the watergaps, which are, fortunately, rather numerous. Railroads in particular seldom attempt the difficult task of climbing or of tunnelling through a ridge in order to save distance; it is more economical to follow a roundabout course along the naturally-graded waterways.

The finest gap in a ridge of Table mountain sandstone through which our route led us was the gorge of Hex river, by which the main railway line from Cape Town to the interior highland makes its way through the mountains. This gorge is peculiarly placed along the axis of a pitching syncline which is formed where two monoclinal ridges of Table mountain sandstone come together—one from the east, the other from the north. The pitch of the syncline is to the northeast, but the course of the river is to the southwest. It is, therefore, evidently not a consequent river, for in that case it should flow northeast with the pitch of the syncline; its course has been taken during the progress of the many changes by which the presumably initial consequent drainage has become adjusted to the structure of the region. The gorge is a superb piece of rock-cutting; great ragged walls of bare sandstone enclose it, expressing their determined resistance by standing up in steep crags. Yet the walls are ravined here and there; and the ravines, even though drained only by wet-weather streams, join the floor of the main gorge essentially at grade, thus exhibiting once again the truth of Playfair's law in so far as non-glaciated valleys are concerned, and pointing the moral of the hanging lateral valleys of strongly-glaciated mountains. A broadly-opened subsequent valley-lowland lay outside—southwest—of the gorge; this was eroded, for the most part, on weak rocks that underlie the Table mountain sandstone. Another open valley lay inside—northeast—of the gorge, this being eroded on the weak overlying (Bokkeveld) strata. On ascending the river and entering the interior valley, we followed the base of the southern wing of the pitching syncline for a number of miles eastward; and, on looking back, we could see the other wing stretching away to the northward, where after a few miles it sank down in what our guide, Mr. Rogers, said was a pitching anticline, thus affording still another repetition of Alleghenian topography; for if there is one thing that is characteristic of the Medina ridges in Pennsylvania it is the submissive way in which, after continuing in strong relief for miles and miles, they gradually decline when the axis of their determining anticline pitches down from a sky-line height and gently sinks underground. The geological maps of the Cape Colony ranges indicate that pitching anticlines occur at several points, and also suggest the occurrence of zigzag ridges in some places; but the only approach to that sort of thing that we actually saw on an Appalachian scale was in the turning ridge which Hex river cuts through, as has just been stated; and the zigzags nowhere seem to reach the extraordinary perfection that they attain in the Pennsylvanian Alleghenies.

There is another and a larger relation in which the drainage of the Cape Colony ranges resembles that of the Alleghenies. In both these ranges the rivers rise in the interior plateau and flow across the belt of folded structures to the sea. It is difficult to conceive of such an arrangement of drainage as consequent on the deformations by which the mountain structures were produced; for at that time the anticlinal crest-lines of the folded belt, as shown in Fig. 2, must have been much higher than the generally undisturbed surface of the interior district, now included in the corresponding plateaus. It is possible to conceive that the through-going rivers are of antecedent origin; but such a suggestion is at the best only a gratuitous hypothesis, with nothing to support it. Indeed, the many changes that the rivers of both these folded mountain systems have undergone, during the adjustment of drainage lines to weak structures, make it very unlikely that any antecedent rivers still remain unchanged since the time preceding the production of the anticlines and synclines. The transverse through-going rivers, of which the Gouritz and the Gamtoos are the chief examples in the Cape Colony ranges, are most plausibly regarded as having been in some way developed during the successive cycles of erosion that the region has suffered; the chief processes in this development being headward erosion and capture, especially during the earlier stages of whatever cycles of erosion the region has witnessed, for then the incision of valleys takes place most rapidly; and especially whenever a tilting of the region has occurred, for at such times the headward erosion by streams that are steepened is greatly accelerated.

It is worth pointing out in this connection that the rivers which cross the Alleghenies from the interior plateau to the Atlantic—namely, the Hudson, Delaware, Susquehanna, Potomac, and James—are all occupants of that central part of the Appalachian system in which the belt of older crystalline rocks, the presumable "oldland" or source of the Appalachian sediments, has been most depressed and encroached upon by the sea — witness the strong overlap of the coastal plain strata on the crystalline belt from New York to Richmond; while farther northeast in New England and southwest in North Carolina, where the belt of older crystalline rocks is wider and higher, there are no transverse rivers corresponding to those of the central district. Indeed, the rivers that rise in the highlands of North Carolina—namely, the New-Kanawha and the Tennessee—still flow northwestward across the plateau, as if thus retaining in a general way the courses given to them by the mountain-making uplift of the region. In South Africa, the rivers which traverse the Cape Colony ranges have now no "oldland" whatever to encounter; and if any "oldland" ever existed south of the ranges, as has been suggested in a previous paragraph, it has been completely lost by erosion and submergence.

The North-and-South Ridges of Southwestern Cape Colony.—The north-and-south ridges of the Cape Town district, of which the Table mountain range is one, differ from the east-and-west Cape Colony ridges in several important respects, although both are made of the same heavy sandstone formation. The north-and-south ridges are of moderate length, as from ten to fifty miles; while the east-and-west ridges may extend a hundred or more miles, with no interruption save a few narrow watergaps. The lowlands of erosion between the north-and-south ridges are broader and smoother than those between the east-and-west ridges; and owing to the shortness of the ridges the broad lowlands are confluent around their ends, thus offering a much larger proportion of surface available for continuous occupation and for easy communication than is the case among the east-and-west ridges. But the chief contrast between the two groups of ridges is in regard to their structure, for several of those now under consideration seem to be of synclinal or downfaulted structure; none that we saw present the regular

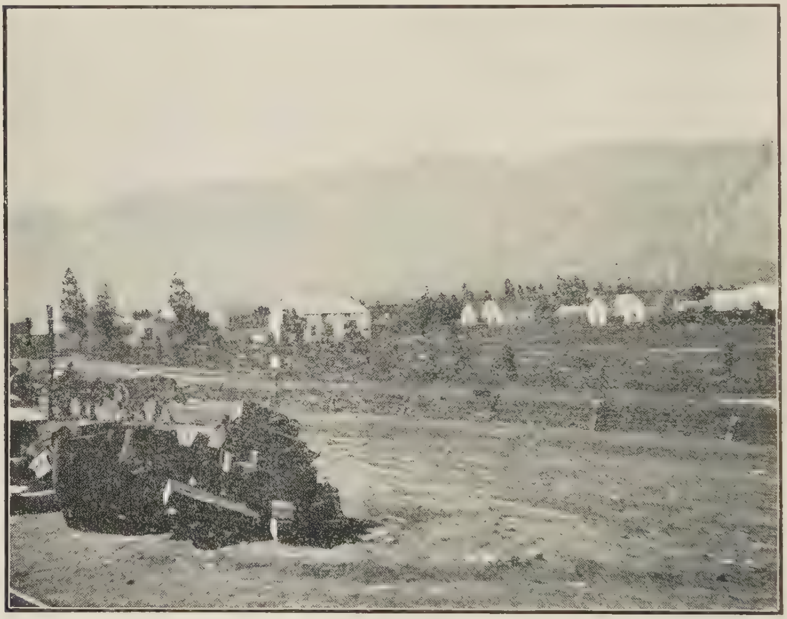

FIG. II.—VILLAGE NEAR THE DRAKENSTEIN RANGE.

anticlinal structure that prevails so persistently in the east-and-west ridges. It should be stated, however, that this inference as to the prevailing structure of the north-and-south ridges is not so well grounded as is the statement concerning the anticlinal structure of the others. The inference is indeed based largely on general relations of the north-and-south ridges to the surrounding lowlands of older rocks, rather than on a clear view of stratigraphic succession. The only consistent reason that can be given for the deep erosion of the lowlands and the preservation of strips of Table mountain sandstone in the isolated ridges is that the eroded lowlands represent areas where the once universal cover of the heavy sandstones was relatively elevated, so that when it was once cut through it was actively sapped by the removal of the weaker underlying strata; while the isolated ridges mark areas where the heavy sandstones were relatively depressed—perhaps below the baselevel of an earlier cycle of erosion—and where their erosion was therefore delayed for a longer period.

In consequence of presenting outcrop faces, which break across the stratification of the sandstones, the sides of the north-and-south ridges (Fig. 11) are much more rugged than are the slopes of the east-and-west anticlines, in which the flanks of the ridges may accord rather closely with the bedding planes, and may therefore be of smoother form. It is for this reason, apparently, that a north-and-south range—the southern extension of the Cedarbergen—on the eastern side of the valley of upper Berg river is of so striking and picturesque form, in strong contrast to the even slopes of the Klein Zwartberg. There is, indeed, in some of the north-and-south ridges so ragged a dissection that they may be described as serrate, for their crest-line shows many irregularities in the way of peaks and notches.

The contrast between the different ranges thus pointed out is furthermore of value because it serves, when properly interpreted, to correct a widespread misunderstanding. It is often stated that anticlinal ridges characterize modern mountain systems, while synclinal ridges prevail in ancient and greatly-eroded mountain systems; but it is a mistake to suppose that there is really so simple a relation as is thus implied between structure, time, and form. Another element enters the problem—namely, the attitude of the anticlinal and synclinal structures with respect to the controlling baselevel; and until this is taken into account no comprehensive explanation of the problem can be reached. Here, as in the various other features already considered, the similarity of the Cape

Colony ranges and the Alleghenies is again very marked, and as the latter are the more familiar, they will be first briefly considered in this respect, by way of introduction to the South African examples.

The Alleghenies are frequently instanced in support of the above-stated generalization as to the prevalence of synclinal ridges in ancient and greatly-eroded mountain systems, but, as a matter of fact, the Alleghenies give the generalization no real support.* The mountains of Pennsylvania are for the most part not synclinal ridges, although such ridges do predominate for a local reason in a certain part of the State—namely, in the anthracite district of the upper Schuylkill river. The commonest type of Allegheny ridge in Pennsylvania is the monocline, or limb of a wide anticline or syncline; the next commonest, judging by measured length of occurrence on the maps of the State Survey, is the anticlinal ridge, of which Tuscarora mountain, in the southern-central part of the State, is a superb example; and synclinal ridges are really less common than either of the other types.

As to the theory of the case, the essential elements on which the form of eroded mountains depends are not simply structure and time, as the generalization above quoted would imply, but structure, baselevel, and time. In a long-eroded mountain system of folded strata all the residual reliefs will be of hard strata, whether the hard strata are synclines or anticlines or monoclines; no elevations of weak strata, whatever their structure, can then survive. At such a stage of erosion it is truly necessary that a syncline whose hard strata stand somewhat above baselevel should form a ridge, as at *S*, Fig. 12; for the hard strata along the synclinal axis will then be left in relief by the erosion of the once higher parts in the adjoining anticlines, and by the peneplanation of the underlying weaker strata in the subsequent lowlands. It is, however, equally natural that an anticline whose hard strata stand in a similar attitude above baselevel may also stand up as a ridge, as at *A*, Fig. 12. Time is, therefore, not alone in control; relation of structure to baselevel is quite as important. In Pennsylvania it is precisely the above-stated relation of structure and baselevel which determines the occurrence of the various anticlinal and synclinal ridges. Inasmuch as the axes of the folds are not horizontal, but rise and fall gently when followed along their trend, synclinal ridges *B*, *C*, will be developed whereever synclines of hard sandstone rise somewhat above baselevel, while the adjoining anticlines of the same strata are high up in the air; an anticlinal ridge, *R*, will survive in another district where an anticline of sandstone stands somewhat above baselevel, while the adjoining synclines of the same strata are deep underground; and monoclinal ridges of Medina will connect these apparently incompatible forms through the intermediate district.

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* See A. P. Chittenden, Mountain Structures of Pennsylvania: BULLETIN *Am. Geog. Soc.*, *1897*, *No. 2*, *175–180*.

The same control of form by structure, baselevel, and time is illustrated by the distribution of anticlinal and synclinal ridges in South Africa. The ridges of the east and west Cape Colony ranges are of anticlinal structure, as in Fig. 2, because it happens that the resistant folds of Table mountain sandstone repeatedly rise effectively above baselevel in that district; the ridges stand forth to-day because the weaker overlying Bokkeveld strata have been worn away from above and alongside of them. This is simply and entirely because these resistant sandstones repeatedly rise in anticlinal structure to a height, with respect to present baselevel, appropriate for the formation of strong ridges, just as many anticlines of strong sandstone rise effectively above baselevel in central Pennsylvania. The north-and-south ridges of the Cape Town district are, on the other hand, synclines (or down-faulted masses) of Table mountain sandstone, because it is only those relatively depressed parts of the originally universal sandstone cover that now stand at a moderate enough altitude above baselevel to have escaped destruction; the corresponding anticlines are all long since consumed.

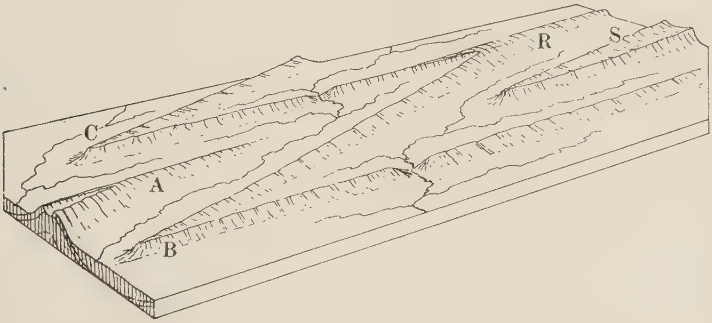

FIG. 12.—DIAGRAM OF ANTICLINAL, SYNCLINAL AND MONOCLINAL RIDGES.

It follows from this that the general attitude of the Table mountain sandstone must be higher in the Cape Town or southwestern district than farthest east; this inference is confirmed by the exposure in the lowlands between the north-and-south ridges of large areas of the underlying Malmesbury slates, which are hardly seen among the east-and-west ranges. There can, consequently, be no doubt that the contrast between these mountains of the same sandstone, but of contrasted structures, is not dependent on the age of the mountains, but simply on the attitude of the mountain-making sandstones with respect to the controlling base-level.

Contrasts of Climate between the Alleghenies and the Cape Colony Ranges.—It happened that immediately before sailing from New York, July 15, 1905, on my way to South Africa, I had spent a week in central Pennsylvania with the members of an inter-collegiate Appalachian summer course in geology; and the characteristic features of that picturesque district were therefore fresh in my memory. Little more than a month later I was in the Cape Colony ranges, and the repetition there of many structures and forms that had been seen at home was very manifest. But striking as were the many points of similarity between the two mountain systems, there was an element of difference that was still more impressive. This was the contrast as to vegetation and habitability, dependent on climate. The difference of temperature experienced in the two regions was not significant, for this was due to a difference of season; the weather during the week in Pennsylvania had been a severe example of the sweltering heat of our northern summer, while the weather that we had in the Karroo was agreeably mild by day and somewhat below freezing at night, appropriate to the end of the southern winter. The significant contrast was that between the sufficient rainfall of the eastern United States and the insufficient rainfall of South Africa.

The southern coast of South Africa receives a moderate rainfall, but it is a rainfall of sub-tropical type, and falls chiefly during the winter months; it is, therefore, of less value to vegetation than a similar fall would be in summer. The highland of the Veld also has a rainfall of medium value, about 30 inches a year, increasing eastward, and there the greatest part of the fall is in summer. But the Karroo, or district of the inner ranges and adjoining margin of the highland, has a somewhat smaller rainfall than either the coastal border or the interior plateau; it is an arid region, unattractive to settlement. The Medina sandstone which makes most of the Pennsylvania ridges is apparently as resistant a rock as the Table mountain sandstone, the chief ridge-maker of South Africa; but the Pennsylvania ridges are beautifully forested, and between the trees there is an abundant growth of shrubs and smaller plants. The Cape Colony ridges are for the most part entirely wanting in trees; even bushes are scanty on the barren sandstones, and the surface presents a large amount of bare rock and soil. The valleys among the Allegheny ridges are fertile, particularly where the soil is derived from limestones; they are all well occupied by an agricultural and manufacturing community: in those districts where the coal-beds have not been removed by erosion a dense population is gathered around the numerous productive mines. The valleys that we saw between the Cape Colony ranges had a pleasing and hospitable appearance where they are not too far inland to receive sufficient rainfall; those which we crossed on the way inland from Cape Town were occupied by occasional villages of thrifty appearance, with fields of repaying fertility around them and ragged mountains in the background, as in Fig. 11; but in the interior country the lowlands were for the most part empty and desolate. Even on the railway line villages were small and far apart; roads led out from them across uninhabited tracts for miles and miles. The village of Matjesfontein, shown in Fig. 8, gives an over-encouraging idea of the possibilities of the Karroo district; for this neat settlement is largely the work of a wealthy contractor, who finds his pleasure in overcoming the adverse conditions of a dry climate at whatever cost. The extensive view that we enjoyed from a knob of the Witteberg ridges over a broad longitudinal valley revealed only one house. Even along the streams there was no considerable amount of irrigation, because the volume of water to be had in the dry season is so small and so fluctuating. We saw flocks of sheep and goats, and marvelled that they could find subsistence where herbage was so scanty. Ostrich-farming seemed more appropriate to this dry country; but even ostrich farms were few and far between in the upper valley of Buffels river near Laingsburg. We often turned from the depressing effects of this desolate landscape to look at the plants that had learned to grow there, and heard with interest from the botanical members of the party accounts of the peculiar devices by which vegetation was enabled to survive in the dry country.

The same absence of tree growth and the same great extent of unoccupied country prevail over the highland of the Veld, until far towards the north we come upon the open forest of ungraceful trees which gives the name of Bushveld to that region. South of this area of natural forest the only trees are pines from the Mediterranean, which are now abundant around Cape Town, and gums and wattles (eucalyptus and acacias) from Australia: but this statement does not apply to the east coast, where there is more rain and abundant tree growth.

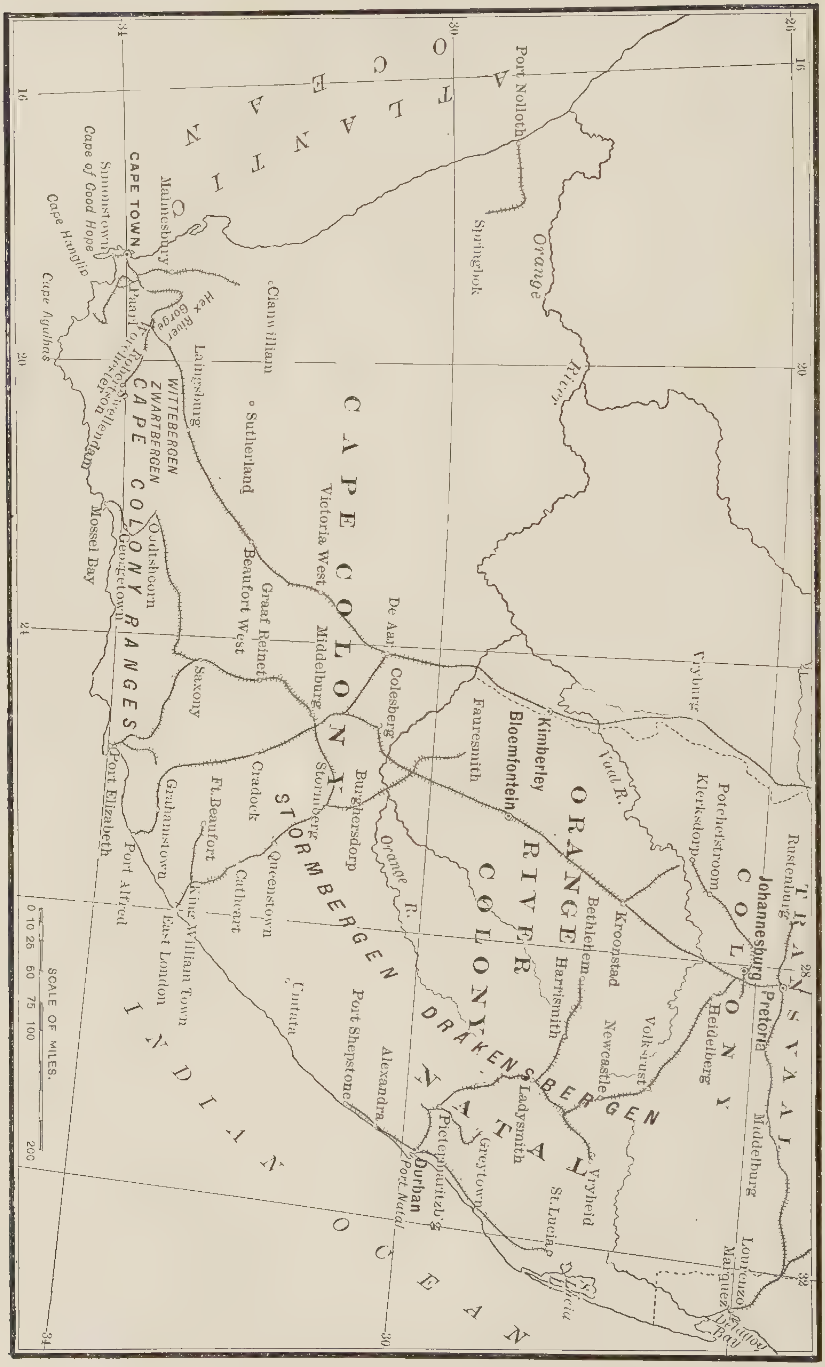

FIG. 13.—OUTLINE MAP OF SOUTH AFRICA.

The Veld and its people reminded us often of what may be seen in our open western country, all the more when coming upon the great mining camps of Johannesburg and Kimberley; but with the difference that in South Africa the labouring population is largely made up of native blacks, now supplemented on the Rand by the fifty thousand Chinese whose importation has caused so much feeling in England. Even to us, as passing strangers, it was evident enough that the long-lasting problem of the native races was the greatest which the Europeans in South Africa have to face—far greater than the temporary misunderstandings that caused, and that still in a measure follow, the Boer war; greater than the difficulties due to lack of rainfall, and to the absence of lofty mountains and of the perennial streams that they would supply; greater than the trouble over rinderpest and other diseases of livestock. In a generation or two the Boers and the English will undoubtedly come to a sufficient understanding, and live together with no more enmity than that of political parties in a self-governing colony; diseases of cattle will be largely controlled by scientific treatment; wherever water supply is available it will be utilized in irrigation, and where water cannot be obtained much of the open country will serve as pasture-ground for wandering flocks. But the problem of the native races is long lasting; and its just settlement will call for no small degree of calmness and wisdom on the part of the Colonial Government—a calmness that shall withstand even the worries arising from headstrong action on the part of the occasional irresponsible and vulgar-minded whites, and a wisdom that shall commend itself even to the ignorant blacks.

It was very profitable to see on the Great Excursion those features of South Africa which repeated physiographic features well known at home, and even more profitable to gain some appreciation of the huge difficulties that the people of another part of the world have to contend with, for thus our sympathy with the Southern Colonies comes to have a sociological as well as a physiographic basis.

Fig. 1. A glaciated ledge of diabase, near Riverton, on the Vaal river, north of Kimberley, Cape Colony. This ledge has been denuded of its cover of Dwyka tillite in recent times. The glacial action by which it was rounded and striated was of Permian date.*

Fig. 2. Diagrammatic section of the Cape Colony ranges, looking east. The oldest rocks, inferred here from outcrops farther

west, are Malmesbury (Archæan?) slates and intrusive granites; then follow the heavy Table mountain sandstones (dotted), the marine Bokkeveld (Devonian) series, the Witteberg sandstones (dotted), the Dwyka glacial tillite, and (on the left) the Ecca, Beaufort and Stormberg series of the Karroo system (unshaded) with dikes and sheets of dolerite.

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* This figure is from a photograph lately received from Prof. Young of Johannesburg. The other photographic views in this article are from negatives by the author.

Fig. 3. The peneplain of the Veld, near Volksrust, eastern Transvaal. Water is locally ponded in the deep channel of a stream.

Fig. 4. Hlobani, a dolerite mesa, surmounting the Veld in the Vryheit district, Natal. Ant hills in the foreground. A Zulu Kraal (village) barely perceptible in the middle distance, directly above the nearer ant-hill. On this mesa, Col. Evelyn Wood, assisted by Piet Uys, a Boer, led an attack against the Zulus in 1879.

Fig. 5. Majuba hill, a residual eminence rising over the peneplain of the Veld on its eastern border, in the district of Vryheit, Natal. It was on this hill that Sir George Colley and many of his men were killed in a disastrous fight with the Boers, February 26–27, 1881.

Fig. 6. The open pit of the Kimberley mine, Kimberley. The upper sloping walls consist of the relatively weak Kimberley (Ecca?) shales, about 200 feet thick; the shales are covered with a sheet of diabase; at their base comes the Dwyka tillite, here only a few feet thick. The vertical walls show the shape and size of the "pipe" of diamond-bearing "blue ground"; the walls consist of diabase for about 400 feet, then of quartzite and quartzitic shales for some 700 feet, below which follows a great depth of quartz porphyry. The open shaft is 1,500 feet deep; less than half its depth is here shown. The mine is continued by shafts downward for another 1,000 feet.

Fig. 7. A group of small Matopos or weathered granite knobs, near Bulawayo, Rhodesia. The foreground is an arm of the peneplain which is hereabouts developed on disordered schists.

Fig. 8. Matjesfontein, an exceptionally neat village in the Karroo district, Cape Colony, a short distance west of Laingsburg. In the background (south), the Witteberg ridge is of anticlinal structure, with steep dips and overthrusts on the near side. The foreground is occupied by Dwyka tillite. The structural location of this view is at *A*, Fig. 2.

Fig. 9. Ideal diagram, representing four stages of erosion on a series of folded strata. The background shows the effect of folding without erosion, with consequent ridges and valleys. The second block shows a small amount of erosion in the consequent synclinal valleys, while the crests of the anticlinal arches are breached and converted into longitudinal subsequent valleys. In the third block the anticlinal valleys have been greatly enlarged and deepened in weak strata, so that the original synclinal valleys are converted into residual synclinal ridges. The fourth block

(foreground) exhibits a stage of erosion after the synclinal mountains have been removed, and replaced by resequent synclinal valleys; while the anticlinal subsequent valleys of the second stage are here replaced by resequent anticlinal ridges.

Fig. 10. A serrated monoclinal ridge of Witteberg sandstone, near Buffels river gorge, looking southwest. The structural location of this ridge is indicated at *D*, Fig. 2.

Fig. 11. Drakenstein ridge, inland from Cape Town, looking northeast.

Fig. 12. Diagram of anticlinal, synclinal and monoclinal ridges, formed by extensive erosion of folded strata, the axes of the folds pitching gently to the right.

Fig. 13. Outline map of South Africa. Nearly all the localities mentioned in the text are here indicated.

GEOGRAPHICAL RECORD.

AFRICA.

Determining Longitudes in Africa by Telegraph.—Captain R. Ommanney, R. E., and Captain G. F. Evans, R. E., returned to England at the end of June on completion of the telegraphic longitude work for which they were sent to North Nigeria last autumn. Starting at Lagos in the middle of November, 1905, the expedition worked up the telegraphic line *via* Jebba and Lokoja, and then along the line which goes through Zunguru and Zaria to Kano. Working eastwards, Leri and Bauchi were fixed, and on the return journey the telegraph line along the River Benue was used to determine the positions of Ibi, Keffi, and Loko. In all, the longitudes of fifteen important towns in Nigeria were determined with reference to Lagos, the longitude of which had already been fixed by cable from Cape Town. The mission involved a march of about 2,000 miles, and much arduous work.—*Scott. Geog. Mag.*, No. 8, 1906.

Ruwenzori and the Sources of the Nile.—In the paper which Mr. Douglass W. Freshfield read before the Alpine Club on his journey to Ruwenzori (*Alpine Journal,* No. 173) he said that if he were to go again to this Central African range, he should make every effort to get to the top soon after dawn, before the clouds concealed the view of the Nile sources. He thinks this view would be unique, with both Victoria and Albert Nyanza in sight and embracing practically the whole region of the Nile sources. It is probable that Ruwenzori may be frequently visited in the coming years. The Nile route to Uganda already opened will very soon be greatly improved and quickened, and before long travellers will go down the Red Sea and return by the Nile. Ruwenzori is a fortnight's march from Lake Victoria and about a week's from Lake Albert. A four months' winter tour may suffice for the round, including a visit to the mountain.

The Natal Government Museum.—Natal has just issued its first Report (for 1904) of the Museum at Pietermaritzburg. The volume of 185 pp. is illustrated with half-tones of the fine Museum building erected in 1902-03 and of some of the exhibition rooms. The Ethnological Department promises to be especially important. Many valuable specimens of native workmanship have already been procured; and it is time, for the native population is being profoundly modified by its contact with the white man, and the use of many of the things they have manufactured for generations will soon completely die out. The catalogue of the exhibits fills 146 pages. In a country where mining and agriculture are foremost, much attention has naturally been given to collections illustrating these occupations. Besides this institution the principal museums in South Africa are the Chamber of Mines Museum in Johannesburg, the Museum and Zoological Gardens and the Geological Survey Museum in Pretoria, the Orange River Colony Museum at Bloemfontein, the Cape Museum and the Marine Laboratory at Cape Town, and the Museums at Grahamston and Port Elizabeth.

Distribution of Villages near Tangier.—In his book "Explorations au Maroc," Mr. Louis Gentil says that soon after leaving Tangier on his way to Tetuan he observed that the villages were invariably ranged along the base of high sandstone cliffs. As the distribution of the water sources probably accounted for the position of the villages, he investigated the matter, and found that the Eocene sandstones at their contact with the Cretaceous clays formed a remarkable water horizon, whose points of emergence might thus be determined by the stratigraphy. A geological map of the region, well made and sufficiently detailed, would thus have prime importance from the hydrological point of view. Nearer Tetuan he observed another illustration of the same sort, where at the contact of the secondary and primary rocks water is found and the houses are therefore ranged along this line of meeting.

Climate and Railroad Cars in Africa.—In a recent address before the Royal Meteorological Society of London, Dr. H. R. Mill, describing a visit to South Africa during the British Association meeting last year, called attention to the way in which the cars on the Uganda Railway are adapted to meet the peculiar conditions of the region. In order to defy wood-loving insects, the cars are built of metal. They have very deep ventilators, protected by wire gauze against mosquitoes. The windows are provided with green-tinted glasses, to enable the passengers to see the landscape and at the same time have protection against the merciless glare of the sun. R. De C. W.

Glacial Phenomena in Griqualand West.—Messrs. R. B. Young and J. P. Johnson describe in the *Transactions* of the Geological Society of South Africa (Vol. 9, pp. 34-39) the glacial phenomena of Dwyka age which they had many opportunities of observing during a recent journey through Griqualand West. The glaciated surfaces occasionally consist largely of beautiful *roches moutonnées,* rising above the general level, but more frequently the surfaces are flat or only gently curved. All of them exhibit glacial markings, excepting the exposure at Blaauwbanksfontein, where, even at the junction of the rocks and the overlying moraine, none of the usual markings is observed. Well-marked glacial grooves frequently occur and testify to the erosive action of the ice-sheet. Two of these are seen on a *roche moutonnée* of diabase which is shown in the illustrations. The striæ are generally very well preserved. Long lines of "chatter marks" are very common, the graving tool in these cases having been a boulder or pebble held in the unsteady grip of the ice. The glacial markings go to prove that the general trend of the ice movement was from the northeast to the southwest. The covering of moraine varies locally in thickness, but there is a well-marked thickening from the northeast to the southwest. At Riverton and in the sections exposed in the mines at Kimberley the thickness varies from about 10 feet to *nil*. The glaciated surfaces examined were along the western fringe of the Karroo system, following, more or less, the course of the Vaal River and of the Orange River after its confluence with the Vaal as far south as Prieska. These surfaces early attracted the attention of the Bushmen who once inhabited this region, and they covered some of them with carvings or chippings representing deer, the lion, the rhinoceros, the boar, and other animals. Many of these carvings are of considerable age, and testify to the resistance to weathering of the glaciated surfaces.

THE NEW RAILWAY IN THE CONGO STATE.—The railway, 75 miles in length, between Stanleyville and Ponthierville, on the upper Congo, has been completed. It circumvents the stretch of rapids that form the first impediment to navigation on the upper river. Its southern terminus at the head of the rapids is in straight lines, about 1,070 miles from Zanzibar and 970 miles from the mouth of the Congo. The purpose of the Congo State is to carry railways around the few parts of the river which are obstructed by rapids, so as to extend unbroken steam transportation to the end of the farthest navigable reach of the Lualaba River, the head branch of the Congo. The railway just completed has added 261 miles of steam transportation to the 1,325 miles already in operation between the Congo mouth and Stanley Falls. Navigation is again impeded at Kindu, 186 miles above Ponthierville, and the Government will build a stretch of railway from Kindu to Buli, about 180 miles, above which there is navigation for 372 miles, where the importance for commerce of the Congo and its Lualaba extension practically ends. The total length of steam transportation along the Congo, when the last mile of rails shall have been laid, will be about 2,144 miles, of which 1,548 miles will be by water and 596 miles by land. The end of the long route will then be in touch with the great mining region of Katanga, which needs transportation for the development of its copper and gold resources.

AMERICA.

NEW YORK STATE RED BOOK FOR 1906.—The issue of the annual, with 360 pages, is larger than heretofore on account of many changes in the Highway Law last winter and the need to give ample space to directions, and information for the guidance of road officials. The improvement and maintenance of over 74,000 miles of public highway in this State are of vital importance, and it is certainly desirable to assure fulness and clearness in the road book. First-class roads are defined as the main travelled roads of the county leading to or connecting the principal centres of population. State Engineer Van Alstyne writes that these roads should have their grades reduced, their drainage made as perfect as possible, and their surfaces covered with macadam, gravel, or other suitable material of sufficient thickness to prevent much injury to the road surface. Second-class roads comprise all that are not designated as first-class roads. The sections of the law relating to the repair and maintenance of both classes are quoted. One hundred and twenty pages give the road improvement statistics for 1905 of every town in the State. A number of full-page pictures from photographs are very instructive. Some of them show highways before and after the grade is reduced and roads that are not properly repaired. In one case State aid was withheld because the Highway Commissioner did not remove loose stones, and in another instance because stones, sod, and organic matter, instead of being removed, were scraped to the centre of the road, forcing travel to its sides.

NAVIGATION OF HUDSON STRAIT.—A favourable report regarding the navigation of Hudson Strait was recently received by the Mounted Police Department of Canada. Major Moody, commanding a police expedition, reported that navigation was not closed last year until November 23, and this year navigation opened on June 28. It is expected that with specially-built vessels the navigation of the Bay and Strait will be possible for over four months.

REVIVAL OF MINING IN NEVADA.—Long ago the gold and silver pouring out from the Comstock, Eureka, and Tuscarora mines made the State of Nevada famous. After a sleep of thirty years, she has once more opened her wonderful treasure vaults. Tonopah, Goldfield, Searchlight, and other camps have vindicated the reputation of the desert State and impressed the world by their production. No longer is the geologist under the necessity of confining himself to obituary notices of decadent camps. Tonopah, for one, is very much alive, and the report on its geology and mineral resources by Mr. Spurr (*Prof. Paper* No. 42, U. S. Geol. Sur.) is a timely publication, which will be read with much interest by mining engineers and geologists (*Economic Geology,* Vol. 1, No. 7, 1906).

The Tonopah mining district was discovered by a prospector named James L. Butler in 1900. He found ledges of white quartz and took specimens to an assayer, who was so little impressed with the samples that he threw them into his waste-pile. On his return journey Butler broke off more samples from the same ledge, and another assayer reported values of $50 to $600 per ton in silver and gold. Ore worth over $4,000,000 was extracted before the end of 1901, but the companies owning the mines later gave much more attention to development work than to mining.

GEOLOGY AND UNDERGROUND WATER RESOURCES OF NORTHERN LOUISIANA AND SOUTHERN ARKANSAS.—The U. S. Geological Survey prints this comprehensive report by Mr. A. C. Veatch as "Professional Paper" No. 46. The work is divided into six sections, of which the first discusses the geological history and topographic development of the region, and treats in detail of the manner in which this part of the coastal plain was formed and of the broad geological facts on which the conclusions reached in the succeeding chapters are based. The second chapter states the fundamental principles governing underground waters and applies them to this region. Methods and cost of well-making are discussed in the third, and the underground conditions in each county are described in the fourth section. The fifth section is an alphabetical arrangement of all the well data collected up to this time, and the report concludes with a Dictionary of Altitudes, arranged by counties, and based on precise levels.

ANNUAL REPORT OF THE GEOLOGICAL SURVEY OF CANADA FOR 1901.—This volume, only recently issued, contains a considerable number of reports of later date. The report on the Klondike gold fields by R. G. McConnell is based on field work carried out in 1903. Among the other reports are papers describing the survey of the Ekwan River and of the route through Sutton Mill Lakes northward by D. B. Dowling; a long description of the nickel and copper deposits of Sudbury by Alfred E. Barlow, which brings together all the more valuable and critical investigations concerning these apparently inexhaustible deposits; and a description of the Pictou coal field, Nova Scotia, by Henry S. Poole.

FUTURE OF WESTERN CANADA.—Mr. E. B. Osborn read a paper with this title before the Royal Colonial Institute, London, some months ago, in which he said (*Proceedings,* Vol. 37) that great areas of the best farm lands in Manitoba do not yet send a bushel of wheat to the market because it cannot be grown profitably, the nearest railway being too distant. Only 9.70 per cent. of the acreage of Manitoba is at present cultivated. Still, Manitoba is the only one of these western Provinces that can be said to have a fairly adequate railway system. Saskatchewan and Alberta really do not yet possess railway systems at all. Only 0.47 per cent. of Saskatchewan and Alberta (excluding Athabasca, which is now divided between them) is as yet under the plough; but the proportion of good to bad land is as high in those Provinces as in Manitoba. At present the single-line transcontinental road of the Canadian Pacific, with some help from the Canadian Northern, has to do all the work of transportation. When the Canadian Northern is finished and the Grand Trunk Pacific is completed (1911), the area where wheat may be profitably grown will be vastly increased. The speaker was of the opinion that in twelve or fifteen years the Canadian West would provide Great Britain with all the wheat she required.

CANADIAN YEAR BOOK FOR 1906.—The ninth volume of this useful annual, prepared for the current year, has just been printed. Among the features of the book are the tariff schedules of Canada, an alphabetical list of post offices, a long list of dates and events connected with the discovery and history of Canada, and statistical and official data for each of the provinces.

INTERNATIONAL CONGRESS OF AMERICANISTS.—The fifteenth meeting of this body was held at Quebec, Sept. 10 to Sept. 15. The papers presented were of much value, though the attendance was not large. A distinctive feature was the presence of many missionaries from all parts of Canada, who contributed reports on the tribes among whom they are living. South America and Central America were not so fully represented as usual. Delegates were present from Germany, England, Mexico, the United States, and some other countries.

The first meeting was given to the subject of the French in Canada and to historical papers, among the contributions being unpublished documents presented by Abbé Gosselin relating to the Indians of Louisiana, and the following papers: by Prof. E. L. Stevenson on a Hondius map recently discovered by Father Fischer; by Dr. Berthold Laufer on the history of the introduction of maize into eastern Asia; by M. de Villiers du Terrage on the history of Louisiana; and two papers, by Mr. Rivard of Quebec and Prof. A. F. Chamberlain of Worcester, on the Canadian French dialect.

The programme of Tuesday included subjects relating to Mexico and Central America and papers on the Tinné and Athabascan tribes of Alaska and the aboriginal languages of northern California. The principal papers on Wednesday dealt chiefly with the practical efforts to keep alive and to revive Indian art, and Miss Curtis demonstrated the beauties of Indian music by rendering a number of Indian songs.

Thursday was given to a number of papers on the Indian tribes of North America, and a discussion by Dr. A. Hrdlicka of those remains of man that are believed to prove his antiquity on this continent. The conclusions reached were negative, so far as the anatomical differences between these remains and the present types of Indians are concerned. The Friday sessions were devoted to illustrated papers on Mexico and Central America, and to interesting studies of the languages, proper names, etc., of some of the United States Indian tribes. About fifty papers were read by their authors and a considerable number by title in the absence of the authors. Vienna was chosen as the place for the meeting of the next Congress in 1908. Among the prominent scholars present in addition to those named above were Professor Paul Ehrenreich of Germany, Dr. Tozzer, Dr. Haddon, Dr. McIver of Great Britain, and Dr. Boas, Father Morice, Dr. Peabody, Dr. Walter Hough, and Dr. Robert Bell of America.

THE TEHUANTEPEC RAILWAY.—This railway was practically completed over a year ago, and during the past summer the final touches were given to its terminal ports, Coatzacoalcos and Salina Cruz. Next year this Isthmian route is expected to take rank as one of the world's great trade highways. The terminal harbours will be opened for inter-oceanic traffic in December, when the American-Hawaiian line will begin regular service with two fleets between San Francisco, Hawaii, and Salina Cruz on the Pacific and between New York and Coatzacoalcos on the Atlantic. The fleet of the company on this route will have a dead-weight carrying capacity of 108,000 tons. All the steamship lines now running between Europe and Mexico will introduce regular service to Coatzacoalcos, and steamship connections will be established at Salina Cruz with all the Pacific coast ports of Central and South America as far south as Valparaiso. The railway bids fair to increase the prosperity of Mexico, and it will be a boon to international commerce.

SOUTH AMERICAN METEOROLOGY.—It is seldom that meteorological notes are obtainable from much of the interior of tropical South America, and all such contributions are welcome. During a trip made in 1903, Professor Solon I. Bailey, well-known in connection with his establishment of the meteorological station on the Misti (19,200 ft.), followed "A New American Route to the Plain of the Amazon" (*Nat. Geogr. Mag.*, Aug., 1906). Crossing the Andes from west to east, and reaching the eastern crest, we note that "here all the moisture from the wet air, borne by the trade winds across Brazil from the distant Atlantic, is wrung by the mountain barrier and falls in almost continual rain." This is an extremely interesting statement concerning the actual conditions of these trade-wind rains, which are indicated on the rainfall maps of the world and which occur a long distance inland from the ocean on the east because their opportunity does not come until the mountain barrier forces the winds to rise. "Near the summit of the pass only the lowest and scantiest forms of vegetable life are seen. In a single day, however, even by the slow march of weary mules, in many places literally stepping downstairs from stone to stone, we drop 7,000 ft. Here the forest begins, first in stunted growths, and then, a little lower down, in all the luxuriance of the tropics, where moisture never fails. The lower eastern foothills of the Andes are more heavily watered and more densely overgrown than the great plain farther down. Here is a land drenched in rain and reeking with mists, where the bright sun is a surprise and a joy in spite of its heat." The contrast between a trade-wind desert, like the Sahara, and a region of abundant precipitation, like that here described, is chiefly a question of mountain barriers in the path of the prevailing winds.

R. DeC. W.

THE EARTHQUAKE IN SOUTH AMERICA.—Between 7 and 8 o'clock on Thursday evening, Aug. 16, Valparaiso and other coast towns of Chile were visited by a very severe earthquake, causing widespread damage and involving the death of about 1,000 persons. Two distinct shocks were followed, as is usual, by fire, which greatly added to the material loss. The disturbance extended eastward into the Andes, and the coast towns were affected to a greater or less extent as far north as Arica and as far south as Concepcion, a distance of about 1,250 statute miles. The shock at Santiago, the capital of Chile, was very severe, lasted three and a half minutes, and was followed by a heavy shower. The damage at Valparaiso was, however, much greater than at Santiago, and many buildings in one of the best residential sections situated on the lower and softer land between the hills and the bay were destroyed. Seismographs in Europe and other parts of the world plainly indicated the disturbance. It is reported that the cause of the earthquake, as in the recent California disaster, was rebreakage along an old fault-line, extending north and south between the Cordilleras and the coast. Much of the information concerning the great catastrophe has thus far been of a conflicting nature, and an adequate report cannot be expected until the occurrence has been carefully studied.

It is probable, however, that this great earthquake will not receive the thorough study that is being given to the preceding California shocks. So far as we have heard, no important sea wave, resulting from the earthquake, was observed along the South American coast, though such waves were recorded on the coasts of the Hawaiian Islands. The waves reported there varied in height from a few inches to five feet at Hilo and 12 feet in the enclosed Bay of Maalea. The time when these waves were observed shows that they must have been produced by this earthquake.

SUBMARINE GOLD FIELDS.—The *Diario Oficial* (May 16, 1906) of Colombia publishes the contract between the Colombian Government and Mr. Allen Webster, by which the latter is authorized to exploit gold-bearing areas beneath the waters of the Atlantic and Pacific coasts of the Republic for a period of twenty-five years.

MARINE METEOROLOGICAL SERVICE OF CHILE.—The sixth volume issued by the *Servicio Meteorológico de la Dirección del Territorio Marítimo* of Chile, containing data for 1904, continues the valuable reports of a meteorological service whose work is but little known in the scientific world at large. A new station has been in operation at Punta Arenas since Jan. 1, 1905. Some noteworthy diagrams of the various meteorological elements are given for several stations, and also a comparative diagram for the years 1903 and 1904. The stations contributing to this volume are all situated on or just off the Chilean coast. R. DeC. W.

ASIA.

THE FRENCH INDO-CHINESE RAILWAY.—The *Board of Trade Journal* (No 503) describes the journey recently made by Mr. T. F. Carlisle, British Consul at Hanoi, between Hanoi and Yunnan-fu. The railway from Yenbay to Laokay was opened in February last, so that the frontier of Yunnan is now in railway communication with Haiphong, the port of Tonkin. Mr. Carlisle followed the route of the Indo-Chinese railway all the way to Yunnan-fu. It is expected that the line will be completed for traffic in three or four years. The impression his journey made was that the country contiguous to the line is poor, but that considerable population and resources are within easy reach on both sides and will provide an important amount of railroad business. The advantage to traffic will be that goods may be taken by rail from Haiphong to Yunnan-fu in two or three days, and thus avoid the cost and risks of the long journey overland or by the Red River.

THE STUDY OF CHINESE.—Dr. Friedrich Hirth of Columbia University, the well-known Sinologist, recently expressed his views in a communication to the *Evening Post* of New York on the study of the Chinese language. During his many years in China be observed that most foreign students, when left to themselves, do not succeed in grasping the essential points in learning either to speak or read Chinese. If anything can be acquired on the spot it is the spoken language, and far more persons are fairly successful in this than in the reading of a book or a document. The difficulties of the language have to be explained by a foreign, not by a native teacher. Men who wish to make a career in China will find the desirable facilities for instruction in the Chinese language and literature in institutions like Columbia, Yale, and Berkeley, in the United States, or Oxford, Cambridge, London, Liverpool, Berlin, Paris, Lyons, etc., in Europe.

We should imitate the Japanese system in studying Chinese. The Japanese lay the main stress of their young men's studies on the written language—by far the most difficult part of the work before them—and they let the spoken language take care of itself later as opportunities may offer. Western foreigners, unfortunately, usually adopt the opposite course. Student interpreters go to Peking knowing next to nothing about China and its language, and by freely mixing with the population sometimes acquire a wonderful command of the spoken idiom. They are much surprised when called upon later to translate a document to find that they are unable to make sense of the hieroglyphics before them. A first-class interpreter should be able to translate documents and books without the aid of a native; and this is the advantage which the Japanese have over us. Our students should first spend a number of years in University study in order to become thoroughly initiated in the mysteries of the book language, and it will be time enough to attend to the spoken language when they begin to live in China.

AUSTRALASIA.

WESTERN AUSTRALIA YEAR BOOK, 1902-4.—The thirteenth edition of this handbook will be very useful to all who wish to keep pace with the development of the State. It contains nearly 1,300 pages, deals with all parts of the country and all topics of public interest, and has many maps and half-tone illustrations. One of the pictures shows the Mundaring Weir, the highest overflow weir in the world, with a capacity of 4,600,000,000 gallons and a daily output capacity throughout the year of 5,000,000 gallons. This is the great water scheme, now officially known as the Goldfields Water Supply, which was completed in 1903 at a cost of $13,000,000, and supplies water to the gold fields of Coolgardie and neighbouring mining centres and to settlements and areas between the mines and the west coast mountains. The water is pumped from the reservoir, some twenty miles south of Perth, for a distance of 351 miles. There are twelve smaller reservoirs and receiving tanks, and the mining towns and districts are supplied from the final reservoir, which is about 1,200 feet higher than the initial reservoir at Mundaring. The water is raised by pumping installations at eight stations along the principal main, which is 30 inches in diameter.

DIVERSITY OF TONGUES IN NEW GUINEA.—Mr. A. E. Pratt, the naturalist, telling the story of his sojourn among the aborigines of Southern New Guinea in his new book "Two Years among New Guinea Cannibals," says that language is curiously diversified among them. The explorer meets a tribe with a distinct speech, and, camping near them for a time, he learns the common currency of their tongue. A few miles farther on appears another people, perhaps not greatly differing in type, but with another language altogether. Thus at Dinawa, where Mr. Pratt's party were encamped for five months in the foothills of the Owen Stanley Range, the native phrase for "Build the fire" was "Aloba di"; while at Foula, only eighteen miles as the crow flies but much farther on foot, the phrase runs "Aukida pute." He says that the main reason for this linguistic variation is to be found in the fact that travel in the Papuan Highlands is extraordinarily toilsome, owing to the exceeding abruptness of the topography and the endless succession of almost razor-like ridges. Long, rough ascents and descents and devious windings are the portion of the wayfarer who wishes to reach some spot that may even be visible from his last halting-place. Thus the tribes are confined to narrow areas.

EUROPE.

GROUPS OF HABITATIONS IN THE VAL D'ANNIVIERS.—MM. Jean Brunhes and Paul Girardin, Professors of Geography in the University of Freiburg, have a suggestive article (*Annales de Géog.*, No. 82) on the groups of dwellings in this valley and their inhabitants. It is a study on the effect of geographic environment upon human activity. The peasants living here number 2,300. Their home is this narrow Swiss valley leading down from the glacier of the Dent Blanche to the Rhône River. It is only 13 miles long, and in that distance it rises 6,500 feet. Here and there in the narrow valley are patches of arable ground, areas of pasture land, and meadows yielding good crops of hay. The distinguishing fact regarding the inhabitants is that all accompany the herds and flocks wherever they are taken, except to the very highest pastures, to which the shepherds alone resort. There are groups of habitations wherever there is land to till, hay to cut, or grazing for the live stock, and each group of buildings is empty whenever work calls the occupants to some other part of the valley. At any season, entire families may be seen either ascending or descending with their herds and household utensils, as though they were quitting the country. It is not, however, an emigration, but merely one of the periodical migrations of the Anniviards.

They divide the year along the 13 miles of the valley in this manner. In December and January they are grouped with their herds in the lower pastures. In February they live in their villages, where the largest amount of hay is stored. They travel down the valley in March to attend to their vineyards near the Rhône. In April they are back again planting the fields and gardens around their villages. In May and the early part of June they are again gathered at the lower pastures. From the middle of June nearly to October the people are divided into two groups—a small group of men tending the live stock, at the various Alpine pastures, and the others dividing their time between the vineyards and the cultivation and harvesting of the crops around their villages. All descend to the Rhône in late October and early November to harvest the grapes and make wine, and then they return to the lower pastures again.

This strange manner of life simply responds to the economic necessities of the people. The peasants are increasing in number, and must utilize every acre of their cultivated hay and grazing lands. The productive elements of the soil would soon be exhausted if the land were not richly fertilized, and so they must needs move their live stock from place to place at frequent intervals.

They prefer to have homes wherever their labours require them to remain a few weeks. Thus each family has four or five dwelling-places, and to one or another of them they are continually removing their modest household equipment.

POLAR.

The Anglo-American Polar Expedition.—A little later information has been received from the Mikkelsen-Leffingwell party than that appearing in the September Bulletin (pp. 567-68). The expedition on Sept. 4 was in Elson Bay, about ten miles east of Point Barrow, waiting in its sailing vessel, the *Duchess of Bedford,* together with a whaling fleet of about a dozen vessels, for the ice to move off the coast sufficiently to allow of a passage eastward. The channel was reported to be badly blocked for about 100 miles to the east, where good, open water, it was thought, might be found to Cape Bathurst, and possibly to Prince Albert Land, where it was intended to make winter quarters for the first season. The party had heard that their ethnologist, Mr. Stefansson, who had descended the Mackenzie River, was waiting for them at Herschel Island. All the members were in good health, and reported that their vessel was a very satisfactory sea-going craft. It is believed that she will stand the ice well. On the way up to Point Barrow they were able to purchase dogs at St. Lawrence Island, and accordingly did not cross over to Siberia for them.

Large game was reported as being scarce, but ducks were in great abundance. The *Duchess of Bedford* was the first sailing vessel which found its way through the ice to Point Barrow. If the expedition does not get as far east this season as anticipated, there is plenty of work to do, and the party will endeavour to make the most of their time and opportunity. In that event Mr. Mikkelsen plans a sledge journey to ascertain if the rumoured island "Keenan Land" exists to the north of Point Barrow, as whalers have reported; and Mr. Leffingwell will engage in geological investigations in the western area, where such studies have not been made. It is intimated that if the base of their proposed work cannot be reached this season the party may spend an additional year in the Arctic, provided they can obtain sufficient supplies.

The International Polar Congress at Brussels.—Sixteen countries were represented at the First International Polar Congress which met at Brussels on Sept. 7-11, this year. Among the explorers, geographers, and others present were Dr. von Drygalski of the German Antarctic Expedition, Dr. O. Nordenskiöld of the Swedish Antarctic Expedition, MM. de Gerlache, Arctowski, Dobrowolski and Lecointe of the *Belgica,* and Paul Reclus, Dr. Hugh R. Mill, Prince Roland

Bonaparte, Dr. Charcot, Charles Rabot, Herbert L. Bridgman, and others. A committee, consisting of nineteen polar explorers and nine other members, was appointed to formulate the constitution of an International Polar Association. This Committee, afer prolonged sessions, submitted the constitution which was adopted by the Congress. Its provisions are thus summed up (*Scot. Geog. Mag.*, Oct., 1906):

> The Association desires to establish closer relations in scientific matters between polar explorers; to attempt, as far as possible, to co-ordinate observations in polar regions; to discuss the results of polar expeditions; to support, when asked, any undertaking the objects of which are the scientific study of polar regions, especially in pointing out what most requires attention; but the Association will not actually direct or patronize any definite expedition. All nations who have taken any part in polar exploration are to send two ordinary and two extraordinary members, to be elected by the Government or the learned societies of their country.
>
> The representatives are to be preferably polar explorers, and, when possible, one Arctic and the other Antarctic; they are to be elected for six years. Corresponding members can also be elected from among men who have written on scientific matters relating to polar regions. It is probable that the Association will hold a meeting every three years.

Resolutions were adopted to the effect that the Congress considered it advisable to elaborate a scheme for methodical exploration of the polar regions; expressing the admiration of the Congress for the important geographical and geological work carried out in Greenland under the patronage of the Danish Government, and congratulating that Government upon the establishment of the new biological laboratory at Disco; in favour of permanent observatories in countries abutting on polar regions for meteorological and magnetic observations; also in favour of at least three fixed seismological observatories in the polar regions.

THE AMUNDSEN EXPEDITION.—The Associated Press sent the news on Sept. 3rd that Captain Amundsen had arrived at Nome, Alaska, with his expedition, on board the Gjöa. This little vessel has, therefore, completed the northwest passage which was practically accomplished by the Gjöa in September last when she reached King Point, a little west of the Mackenzie delta, where she was frozen in for the winter. Captain Amundsen may not himself return to Europe on his vessel, but he apparently intends to carry out his original purpose, which was, if he succeeded in making the northwest passage, to send the Gjöa home *via* San Francisco and Cape Horn.

VARIOUS.

GEOGRAPHISCHES JAHRBUCH.—The second part of the volume for 1905 has just appeared from the Perthes establishment, Gotha. Dr. Adolf Marcuse of Berlin has prepared the report on the progress of geographical surveying; the preceding review of this subject appeared in the volume of 1902, and was written by Professor E. Hammer. Professor R. Langenbeck of Strassburg sums up the new literature relating to the physics and mechanics of the globe; Professor K. Schering enumerates the many writings of the past five years on terrestrial magnetism; the report on the progress of botanical geography, by Prof. O. Drude, covers the period of 1901-4; Dr. Gähtgens of Strassburg reports on ethnological exploration, which review had been in charge of Prof. Georg Gerland since 1876; Prof. E. Oberhummer of Vienna makes a valuable contribution to historical geography in his report upon the knowledge of lands and peoples of the ancient world; and Dr. Hermann Wagner concludes the book with a list of the representatives of geography in the higher schools of Europe and other countries—a list not entirely accurate for the United States, as Yale University does not appear, and Prof. Goode is assigned to Columbia University instead of the University of Chicago. The literature of terrestrial magnetism for the five years included in Prof. Schering's report is so voluminous that merely the titles of many works are given. A list of all the magnetic observatories, with their latitude, longitude, and magnetic elements, is given. Volumes 5 and 6 of the ten volumes of the scientific results of the German South Polar Expedition (1901-3) will contain the magnetic work.

PROFESSOR GOODE'S SUN BOARD.—Professor Goode of the University of Chicago has devised a small instrument called a Sun Board, which is intended for teachers and classes in geography, meteorology, and astronomy, in their study of the sun as the source of heat in climate. The instrument is substantially made, easily manipulated, and solves a number of important problems with approximate accuracy. It is especially adapted for laboratory work. Among the questions which it helps the observer to answer are the determination of the horizontal plane, the cardinal points, the sun's altitude and azimuth, the latitude of the observer and the area covered by a sunbeam of given size, so that the heating efficiency of the sun at any altitude may be determined; in other words, the observer is able to ascertain quantitatively the intensity of solar radiation, not only from day to day, but for different hours of the same day. The instrument is so simple that it is to be commended even to teachers of the lower grades. It is already rendering good service in a considerable number of schools.

CLOUDINESS AND THE LOCATION OF ASTRONOMICAL OBSERVATORIES.—In an address before the American Philosophical Society at the Franklin Bi-Centennial Meeting ("An International Southern Telescope," Proc. Amer. Philos. Soc., XLV, 1906, 44-53), Professor E. C. Pickering brought out the noteworthy fact that nearly all of the principal observatories are situated in places which are especially unsuited to astronomical work. If the earth be divided into cloudy and clear halves, nine-tenths of the observatories are in the cloudy region. The three extensive clear regions of the world present these conditions: In the interior of Northern Africa there is no large observatory; in South Africa the only large observatory is at Cape Town, which is in an exceptionally cloudy part of that region; and in Australia the two principal observatories are on the cloudy coast, not in the clear interior. The South African clear area probably offers exceptionally good conditions for astronomical work, but whether better than those at Arequipa, Peru, where the Southern Station of the Harvard Observatory is located, remains to be seen. Sir David Gill, Director of the Cape Observatory, has recommended Bloemfontein. R. DEC. W.

PRESSURE CHANGES IN A NINETEEN-YEAR PERIOD.—Dr. W. J. Lockyer contributes to a recent number of *Nature* (Vol. 74, 1906, 352-354) an abstract of a paper read by him before the Royal Society on June 21 last, under the title *Atmospheric Pressure Changes of Long Duration.* It appears that in Australia the pressure curves show principal maxima nineteen years apart. The same thing is found in South America, while the conditions in India are somewhat different, there being a variation of an oscillatory nature, the maxima or minima coming about every ten or eleven years. The Indian pressure curves in general resemble the inverted curve representing solar activity as deduced from the area of sunspots. As the Australian curves are allied to the Indian variations, but are of a modified form, Dr. Lockyer thinks it possible that the modification may be due to some terrestrial cause. It may be recalled that Mr. H. C. Russell has brought forward evidence of a nineteen-year cycle in Australian weather.

R. DeC. W.

The Royal Geographical Society has issued through Mr. E. Stanford a general index to the first twenty volumes of the *Geographical Journal,* 1893-1902. The work is divided into three parts, devoted respectively to papers, maps and general subjects. The geographical field is so well covered by this publication that the index of the first ten years cannot fail to be a very convenient and helpful reference work for geographers.

The University of Greifswald, on the occasion of the celebration of its four hundred and fiftieth anniversary, conferred the honorary degree of Doctor of Philosophy on Professor William M. Davis, of Harvard University.

Dr. L. A. Bauer's resignation from the U. S. Coast and Geodetic Survey took effect on September 1. He has accepted the permanent directorship of the department of terrestrial magnetism in the Carnegie Institution of Washington.

La Montagne reports (No. 6, 1906) that the guide Cyprien Savoie and six French porters have been engaged by Dr. Workman and Mrs. Bullock-Workman to accompany them in their next Himalayan explorations. The party left Srinagar about May 18 for the mountains.

Amherst College has conferred its Doctorate of Science on Dr. James Furman Kemp, Professor of Geology in Columbia University.

PROF. DR. GUSTAVE THIRRING was elected on the 26th of September Director of the Communal Statistical Bureau and of the Municipal Library of Budapest, to fill the vacancy left by the death of Dr. Joseph Körösy.

OBITUARY.

COLONEL DE LANNOY DE BISSY.—Col. de Lannoy de Bissy, long chief of the Cartographic Bureau of the French Army and Colonel of the Fifth Regiment of Engineers, died in France in August. In 1875 he began to prepare his map of Africa, to which he gave all the time he could spare from his official duties for fourteen years. The finished map, on a scale of 31.4 statute miles to an inch, is still the largest map of the whole continent. It was based upon the coast surveys of the British and French Hydrographic Offices and the comparatively few astronomically-fixed points in the interior. He consulted nearly 1,800 route maps and all the writings of African explorers that he could obtain, sifting the facts he used with much pains from the vast material he collated. His work involved many puzzling questions, for explorers failed to agree on many things and even on the directions of mountain ranges and rivers. He gave five months to the drawing of a single sheet showing the Gondar province of Abyssinia; and though often he could not decide correctly between the contradictory assertions of explorers, his insight was keen, his judgment was good, and his map was a remarkable product of the African cartography of its day.

GEORGES LESPAGNOL.—Died on May 29, at the age of forty-one. Professor of Geography at the Faculty of Letters, Lyons, France. Since 1892 he had given all his time to geography, and among the earliest contributions that attracted attention to him was a series of three articles entitled "Caractère désertique de l'Australie intérieure," which was published in *Annales de Géographie* for 1898. He organized the Geographical Institute in the Faculty of Letters.

William Buck Dwight.—Died at Cottage City, Mass., on Aug. 29, aged 73 years. He was Professor of Geology at Vassar College for nearly thirty years, and carried on extensive field work in geology, chiefly in Dutchess Co., N. Y. He was one of the original Fellows of the Geological Society of America.

NEW MAPS.

AFRICA.

Egypt.—Topographical Map of Giza Province. Scale, 1:10,000, or 0.1 statute mile to an inch. Issued in 1905—sheets N.E. 1–3, 1–4, 2–4, 3–3, 3–5, 4–3; S.E. 1–4. Issued in 1906—sheets N.E. 2–2, 2–3, 3–1, 3–2, 3–4, 4–1, 4–2, 4–4, 4–5, 5–1, 5–2; sheets N.W. 5–1, 6–2, 7–2, 7–3, 8–3, 8–4; sheet S.E. 1–3. Survey Department Egypt, Cairo, 1905–6.

Revised sheets of the survey of this Province which was made originally on this scale in 1898–1900.

Cape of Good Hope.—Geological Map of the Colony of the Cape of Good Hope (sheet 1). Scale, 1:300,000, or 4.7 statute miles to an inch. The Geological Commission, Cape Town, 1906.

The Geological Commission was appointed in 1895 by the Cape Government for the purpose of organizing a geological survey of the Colony. The Survey began work in 1896, and, though its work is still far from being complete, sufficient information has been collected to decide many disputed points concerning the fundamental structure of the country. Large areas in the colony, including the whole of the country north of the Orange River and immense tracts in the northwestern, midland, and eastern districts, have not yet been surveyed. The work has been completed in the southwestern part of the colony, and the present sheet is the result of the surveys in the Cape Town Region. Ten tints are used to show the rock formations. The superficial deposits are in white.

Canary Islands.—(1) Skizze einer Höhenschichtenkarte des südlichen Teiles von Palma. (2) Kartenskizze von Lanzarote. Scale, 1:150,000, or 2.38 statute miles to an inch. By Karl Sapper. *Petermanns Mitteilungen*, Vol. 52, No. 7, Gotha, 1906.

These finely-produced maps are the result of Professor Sapper's geographical work on two islands of the Canary group during little more than a month in 1905. The maps are based upon earlier surveys, upon which Professor Sapper has applied contours showing his own determination of heights above sea-level. The contour intervals are distinguished by different tints. The sheet also contains a sketch map of the Montaña de Fuego on a scale of 0.7 statute mile to an inch, with contour interval of 20 meters. These maps, with the accompanying letterpress, are an example of the good geographical work which a trained geographer may accomplish in a summer vacation.

AMERICA.

U. S. GEOLOGICAL SURVEY MAPS.

UNITED STATES.—Geologic Atlas of the United States. Washington, D. C., 1906. No. 139, Snoqualmie Folio, Washington. Scale, 1:125,000, or 1.9 statute mile to an inch.

The quadrangle is situated nearly in the centre of the State in the heart of the Cascade Range. The most valuable mineral resource is coal.

UNITED STATES.—Map of Yampa Coal Field, Routt County, Col. Scale, 4 statute miles to an inch. Bulletin No. 285, 1906.

A preliminary map of the upper valley of the Yampa River, an area of about 1,200 square miles, nearly all of which is occupied by the Yampa coal field, the most important of the coal resources in northwestern Colorado as far as is yet known. The map shows the locations of mines and prospects.

UNITED STATES.—Preliminary Geologic Map of the State of Mississippi. Scale of miles, about 40 miles to an inch. By E. C. Eckel and A. F. Crider. Bulletin 283, 1906.

Illustrates Mr. Crider's paper on Geology and Mineral Resources of Mississippi. It shows that the general geological structure of Mississippi is quite simple. The oldest rocks, of Devonian and Carboniferous age, outcropping in the northeast part of the State, and the newer rocks outcropping south and west of this older mass occupy successive roughly parallel bands, dipping slightly to the southwest, so that a journey through the State, either to the south or to the west, reveals one newer series after another until the very recent alluvial deposits which fringe the Gulf and the Mississippi River are reached.

UNITED STATES.—Preliminary Geologic Map of Northern Louisiana and Southern Arkansas. Scale, 1:1,000,000, or 15.78 statute miles to an inch. Compiled and partly revised by A. C. Veatch, 1902–3. Professional Paper No. 46, 1906.

Shows the Gulf Coastal Plain, an area of low and rounded relief, extending in this region from 3 to 600 feet above sea-level. Contours show the topographic relief. Four geological sections, extended through the area, exhibit the relations of the formations beneath the surface.

U. S. HYDROGRAPHIC OFFICE CHARTS.

Pilot Charts of the North Atlantic Ocean.—September and October, 1906.

The reverse of the September chart reprints the paper by James Page on "West India Hurricanes."

Pilot Charts of the North Pacific Ocean.—October and November, 1906.

On the reverse of the October chart is a description of typhoons in East Asiatic waters.

UNITED STATES.—Post Route Maps. Showing post offices, with the intermediate distances on mail routes in operation on the first of June, 1906. Published by order of Postmaster-General George B. Cortelyou under the direction of A. von Haake, topographer Post Office Department, with insets of most important cities showing postal connections. Scales: 1.5 miles=1 inch, Canal Zone, Isthmus of Panama; 4 miles=1 inch, New Jersey; 5 miles=1 inch, Porto Rico, Maryland, and Delaware, Pennsylvania (two sheets), New York (4 sheets); 7 miles=1 inch, Kentucky and Tennessee (2 sheets), Ohio, Indiana, Virginia, and West Virginia (2 sheets); 8 miles=1 inch, Hawaii, Samoan Islands, and Guam, Georgia, North

Carolina and South Carolina (2 sheets), Alabama, Illinois, Iowa, Mississippi; 9 miles=1 inch, Colorado, Michigan and Wisconsin (2 sheets); 9.3 miles=1 inch, Louisiana, Missouri; 10 miles=1 inch, Minnesota, Florida, South Dakota, North Dakota, Kansas and Nebraska, Oklahoma and Indian Territory, Oregon, Washington, Utah, Arkansas, California and Nevada (4 sheets); 11.5 miles=1 inch, Texas (2 sheets), Arizona, New Mexico; 12.5 miles=1 inch, Philippine Islands (2 sheets); 14 miles=1 inch, Montana, Idaho, and Wyoming (2 sheets); 40 miles=1 inch, Alaska. With list of counties in each State and Territory showing the relative position of each county. Washington, D. C., 1906.

A revision of the post-route maps of this country is always worthy of notice. Aside from the value of these maps, as showing the extent of our post-office and postal-route systems, they serve other important purposes. The comparatively large scales on which the maps are made and the absence of detail that might interfere with the clear expression of the trunk and subsidiary lines of railway make the sheets the most convenient source of map reference as to the entire railway system of the country. The relative importance of the towns and hamlets is also indicated, not only by the symbols for post offices, villages and county seats, but also by the printing of the post routes in such a way as to show whether the towns receive mail daily or only once, twice, or three times a week. Mapmakers may find the sheets useful as a basis from which to trace railways on their small-scale maps and to insure the placing of towns on the right side of streams. They have often been placed on the wrong side by commercial map houses, especially when the draughtsmen have used as the basis of their work small-scale maps with blurred or inaccurate information. Insets of the larger cities show the position of Post Office sub-stations.

It is unfortunate that on these numerous sheets the natural scale should not be given. On too many of our Government maps the student who needs to make careful measurements of distances, expressed in miles to the inch, is required to ascertain this detail for himself. It is believed that all the leading Governments, excepting the United States, now give the natural scale on practically all their official maps.

UNITED STATES.—Archæological Map of the Jemez Plateau, New Mexico. Scale, 7 statute miles to an inch. Bulletin 32, Bureau of American Ethnology, Washington, D. C., 1906.

The archæological features of the map are the result of investigations by the Bureau of American Ethnology, and are to be revised and extended as soon as the necessary data are obtained.

The map accompanies a report by Mr. Edgar L. Hewett on the antiquities of this plateau. The scale of miles is correct; but the natural scale, given as 1:125,000, is not correct.

UNITED STATES.—Geological Survey of New Jersey. Scale, 1:63,360, or 1 statute mile to an inch. Revised edition of the original survey of 1880 and 1883. Sheet No. 21. Contour interval, 10 feet. Henry B. Kümmel, State Geologist; C. C. Vermeule, Topographer. Trenton, 1906.

The revision of this map, now in progress, was noticed in the Bulletin for 1905, p. 499.

CHILE.—Tierra del Fuego. Bahia Allen Gardiner. Scale, 1:25,000, or 0.39 statute mile to an inch. Chart 135, Hydrographic Office, Valparaiso, 1906.

Soundings and heights are in meters.

CHILE.—Puertos de las Islas Guaitecas. Scale, 1:20,000, or 0.31 statute mile to an inch. Puerto Low; Melinca; Puerto Rhone and Puerto Barrientos. Chart 116, Hydrographic Office, Valparaiso, 1906.

The Guaitecas Islands lie to the south of Chiloe Island.

ASIA.

ASIATIC TURKEY.—Map of Eastern Turkey in Asia. Scale, 1:2,000,000, or 31.56 statute miles to an inch. Compiled by Lieut.-Col. F. R. Maunsell, R. A. The *Geog. Jour.*, London, August, 1906.

This map is largely derived from the material collected by Lieut.-Col. Maunsell during his travels in Turkey-in-Asia. In the accompanying notes he indicates the fixed positions, surveys, and other work of earlier travellers, which he utilized in preparing his map, and describes the means by which he made his own surveys. His work is a contribution to the mapping of eastern Asia Minor, and one of the honours of the Royal Geographical Society was recently awarded to him in recognition of this geographical service.

COCHIN CHINA.—Plan der Stadt Saigon. Scale, 800 meters to an inch. Deutsche Rundschau für Geog. und Stat., Vol. 28, No. 12, A. Hartleben, Vienna, 1906.

A well-produced plan of the capital of Cochin China, accompanying a descriptive article. The street plan and public buildings are in red, rivers in blue, and names in black. All important buildings are numbered with reference to a list giving their names.

JAPAN.—Topographical Survey of Japan. Scale, 1,200,000, or 3.1 statute miles to an inch. Sheets Sadowarà, Kumamoto, Kochi, Yamaguchi, Wakayama, Osaka, Nagoya, Tokio, Sakata, and Honjo. Imperial Geological Survey, Tokio, 1891–1905.

The contour interval is 40 meters. Symbols are used to indicate many features, as craters, hot, cold, and mineral springs, varieties of mineral resources, physical and cultural features, etc. The contour lines would be more conveniently useful if the elevations indicated by every tenth contour reaching the margins were given.

PERSIA.—Afghanistan--Seistan. From surveys made during the Seistan Boundary Arbitration Commission under the command of Col. Sir Henry McMahon, 1903–5. Scale, 1:1,000,000, or 15.78 statute miles to an inch. *Geog. Jour.*, September, London, 1906.

Col. Sir Henry McMahon has a paper in this number of the *Geographical Journal* on "Recent Survey and Exploration in Seistan," which this map illustrates. Mr. Tate, the survey officer, and his staff made complete new surveys of the whole country, and all the unsurveyed blanks in Seistan and bordering regions were filled up. About 38,000 square miles were thus surveyed. The map, therefore, contains much new cartographical material. The present Seistan has an area of about 7,006 square miles, of which 2,847 square miles are in Persian and 4,159 square miles in Afghan territory. The map shows that Seistan is a large basin without any outlet to the sea, receiving all the drainage of a vast tract of country, over 125,000 square miles in area, girt on all sides by high mountain ranges.

AUSTRALASIA AND OCEANICA.

AUSTRALIA.—The Geographical Divisions of Australia. Scale, 1:30,000,000, or 473 statute miles to an inch. The *Geog. Jour.*, London, August, 1906.

A black-and white map illustrating a paper by Dr. J. W. Gregory on the economic geography and development of Australia. Three divisions are shown: (1) The East Australian Highlands, ranging from Cape York Peninsula southward to Victoria and flanked to the east by the narrow, interrupted coastal plains of Queensland and New South Wales ; (2) The Great Plains to the west of the East Australian Highlands, which include the basins of the Flinders and Leichhardt rivers, Lake Eyre, and the Murray and Darling rivers ; and (3) The Western Plateau, which is the vast block of Archæan rocks that forms the western half of Australia.

BISMARCK ARCHIPELAGO.—Der Nordwestliche Teil Von Neu-Mecklenburg. Von M. Moisel. *Mitt. v. Forsch. u. Gelehrt. aus den Deutschen Schutzgebieten.* Vol. 19, No. 3, Berlin, 1906.

One of the large-scale maps of little-known regions embraced in the German colonies that have been appearing for years in this publication. The maps are based upon hitherto unpublished surveys by Peter Behrendt (1904) and Capt. Lübbert (1905), Commander of the German naval vessel Moewe. Many details are given which no earlier explorers have depicted.

EUROPE.

THE ALPS.—Carte-Relief du Tirol, de la Bavière Méridionale et du Salzbourg pour Touristes, avec les Pays Limitrophes. Scale, 1:500,000, or 7.8 statute miles to an inch. Kümmerly & Frey, Bern. (Price, paper, 3.50 fr. linen, fr. 4.)

A relief map for tourists showing the topographic forms by skilful use of purple and yellow, and containing the information that may be adequately expressed in this form.

FINLAND.—Die Wichtigsten Seefischereien Finnlands. Taf. XIII–XVI, Publications de Circonstance (Conseil Permanent International pour l'Exploration de la Mer), Copenhagen, 1906.

Four maps showing the distribution along the Finnish coast of the herring, sprat, smelt, turbot, pike, haddock, salmon, flounder and muræna fisheries. Red points show where each variety of fish is caught, and the density of the points marks the intensity of the fisheries at the places indicated.

FRANCE.—Carte Géologique de la France. Par Marcellin Boule. In *Conférences de Géologie*, Masson & Co., Paris, 1904.

A small map in colours, excellent for general reference, but especially intended for students of Prof. Boule's elementary text-book which it illustrates, the text being adapted for preparing students to read intelligently this excellent geological map of their own country.

RUSSIA.—Die Eisenbahnen Russlands. Scale, 1:6,336,000, or 100 statute miles to an inch. By Dr. Carl Peucker. Artaria & Co., Vienna, 1906). (Price, K. 1.80, M. 1.50.)

An excellent map showing the railways of Russia in red. The latest extensions are given, as that from St. Petersburg through Viatka to the Trans-Siberian railway, shortening the distance between St. Petersburg and Vladivostok; also the new line from Vologda to Archangelsk. An index makes it easy to find any of the railways.

SAXONY.—Königreich Sachsen. Scale, 1:300,000, or 4.73 statute miles to an inch. In the series of Woerl's Reisehandbücher: "Das Königreich Sachsen in Wort und Bild." Von Leo Woerl. Woerl's Reisebücherverlag, Leipzig, 1906.

The map, produced by the map house of Carl Fleming, Glogau, is to be commended for the clear and excellent manner in which a large amount of detail is presented. Every hamlet in the kingdom appears to be given; forest areas are shown, as well as railroads, roads, paths, castles, ruins, watering-places, watermills, etc.

SERVIA.—Pflanzengeographische Karte Serbiens. Von. Prof. Dr. Lujo Adamovic. Scale, 1:750,000, or 118.3 statute miles to an inch. *Pett. Mitt.* No. 8, Gotha, 1906.

This is the result of Dr. Adamovic's long observations and studies of botanical distribution in Servia. Six tints and white distinguish the seven vegetation regions into which Dr. Adamovic divides the kingdom—the lowlands distributed in the valleys of the Save, Danube, and other rivers, the hill regions, the submontane (between 500 and 1,200 meters), the montane (chiefly above 1,200 meters), the voralpine, subalpine, and alpine regions, the last found only on the high mountains of Kopanik and Stara Planina, which exceed 2,000 meters. In each of these regions are numerous symbols indicating the most characteristic forms of their vegetation. Four zones of vegetation are also distinguished by broken red lines indicating that the plants of Servia are included in these four divisions of the botanical territory of central Europe. This is a fine specimen of cartographic method in showing the distribution of plants; and the accompanying letterpress illustrates very clearly the relations between geographical environment and plant development.

SWEDEN.—Karta utvisande Strandnings-och Andra Olyckshandelser På Kusterna af Sverige År 1905. Bidrag Till Sveriges Officiella Statistik. Stockholm, 1906.

Shows the position of vessels that were stranded or wrecked on the coasts of Sweden in 1905. The nature of the accidents, the extent of property loss, whether total or partial, the loss of life if any, and other information are indicated by symbols. All the Government lights are enclosed in circles showing the extreme distances at which the lights are effective in clear weather.

ATLASES.

ANDREES ALLGEMEINER HANDATLAS.—In 139 Haupt- und 161 Nebenkarten; nebst vollständigem alphabetischem Namenverzeichniss von etwa 240,000 Namen. Fünfte völlig, neubearbeitete und vermehrte Auflage. (Lieferungen 43–56.) Herausgegeben von A. Scobel. Velhagen & Klasing, Leipzig, 1906. (Price of complete work, M. 28.)

With this instalment of maps and index the new edition is completed. The publishers are to be congratulated upon the excellent results of their latest revision, which will be heartily welcomed by students of the best atlases. Among the new sheets are Nos. 39–40, which contain four maps of communications and industries in central Europe, making one of the best maps relating to economic geography that have appeared in a general atlas; and the political map of Africa, giving the latest boundaries, most of the changes being the result of recent delimitations by joint surveys. An illustration of the care with which the contours of the sea-floor are given is the map of Asia, on which the recent researches of Agassiz and Gardiner in the Maldive and Laccadive Archipelagoes are laid down. The northwest sheet of South America does not show the Departments of Colombia according to their new distribution as fixed last year. The maps of German East Africa, Togo, and Kamerun give a striking idea of the progress made in the past few years in the geographical surveying of those regions. The new edition will confirm the favourable impression this atlas has always made as one of the most convenient and reliable of atlases, and as especially characterized by good judgment in dividing the space among the various regions, fulness and accuracy of information, and good taste and the best technical skill in production.

ATLAS OF THE WORLD'S COMMERCE.—Compiled from the latest Official Returns at the Edinburgh Geographical Institute. Edited by J. G. Bartholomew. (Part 10.) George Newnes, London, and Frederick Warne & Co., New York, 1906. (Price, 25 cents a Part.)

A double-page plate is given to a general commercial chart of the Far East from Afghanistan to Japan showing railroads, canals, steamer routes, river navigation, telegraphs and cables, deep-sea soundings, and the places where British Consuls and agents are established. Colours are used to show forests, grass and cultivated lands, deserts, high mountain flora, etc. On the reverse are product and industrial maps of China, Japan, Egypt, and West Africa. The other map sheet is a general commercial chart of Europe and the Near East, with an industrial map of Europe on the reverse. Diagrams showing the import and export trade of the United Kingdom for 1905 are given. The dictionary of "Commodities of Commerce" is extended from "Slops" to "Turpentine."

TASCHEN-ATLAS DER SCHWEIZ.—26 kolorierte Karten. Von Emile Wagner. (Third edition.) In German and French. H. Kümmerly & Frey, Bern. No date. (Price, fr. 4.)

A pocket atlas containing a general and a railroad map of Switzerland and maps of the cantons on scales of 3 to 10 statute miles to an inch. Most of the maps show the mountains with relief effect by the use of light and shade; also roads, paths, castles, ruins, watering-places, etc. The maps are excellent specimens of cartography; and as the atlas is fitted to the pocket and the maps are on a comparatively large scale, the little work is especially convenient for tourists. The plates are preceded by text, largely statistical, giving much information concerning the Republic, its mountains, and each of the cantons.

ACCESSIONS TO THE LIBRARY.

JULY–SEPTEMBER, 1906.

AFRICA.

d'ALBERTIS, E. A.—In Africa: Victoria Nyanza e Benadir. Illustrazioni, Tavole e 3 Carte Geografiche. Bergamo, Istituto Italiano d'Arti Grafiche. 1906. 4to.

FAÏTLOVITCH, JACQUES.—Notes d'un Voyage chez les Falachas (Juifs d'Abyssinie). Rapport présenté à M. le Baron Edmond de Rothschild. Paris, Ernest Leroux. 1905. pr., 8vo. [*Gift.*]

IRLE, I.—Die Herero. Ein Beitrag zur Landes-, Volks- & Missionskunde. 56 Illustrationen und 1 Karte. Gütersloh, C. Bertelsmann. 1906. 8vo.

KEANE, A. H.—The Boer States. Land and People. With a map. London, Methuen & Co. 1900. 16mo.

PETERS, KARL.—Die Gründung von Deutsche-Ostafrika. Kolonialpolitische Erinnerungen und Betrachtungen. Kunstbeilage, Abbild., &c. Berlin, C. U. Schwetschke und Söhne. 1906. 8vo.

TROTTER, J. K.—The Niger Sources and the Borders of the New Sierra Leone Protectorate. Four illustrations and map. London, Methuen & Co. 1898. 16mo.

AMERICA.

ARTHUR, RICHARD.—Ten Thousand Miles in a Yacht. Round the West Indies and up the Amazon. (Illustrations.) New York, E. P. Dutton & Co. 1906. 8vo.

BACON, EDWIN M.—Connecticut River and the Valley of the Connecticut. Illustrated. New York, G. P. Putnam's Sons. 1906. 8vo.

BALCH, WILLIAM RALSTON.—Mines, Miners and Mining Interests of the United States in 1882. (Maps, &c.) Philadelphia, Mining Industrial Publishing Bureau. 1882. 4to.

CONDRA, GEORGE EVERT.—Geography of Nebraska. [Map and Illustrations.] Lincoln, Neb., University Publishing Co. 1906. 16mo.

DORSEY, GEORGE A.—Mythology of the Wichita. Collected under the Auspices of the Carnegie Institution of Washington. Washington, D. C., Carnegie Institution. 1904. 4to.

DORSEY, GEORGE A.—Traditions of the Arikara. Collected under the Auspices of the Carnegie Institution of Washington. Washington, D. C., Carnegie Institution. 1904. 4to.

DORSEY, GEORGE A.—Traditions of the Caddo. Collected under the Auspices of the Carnegie Institution of Washington. Washington, D. C., Carnegie Institution. 1905. 4to.

JORDAN, DAVID STARR, AND EVERMANN, BARTON WARREN.—American Food and Game Fishes. A Popular Account of all the Species found in America North of the Equator, with keys for ready identification, &c. Colored Plates, &c. London, Hutchinson & Co. 1902. 4to.

LAVERY, ADELBERT A.—Geography of Saratoga County, State of New York. [With map.] Ballston, [Printed for the Author,] 1905. pr., 8vo. [*Gift from the Author.*]

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BOOK NOTICES.

British Rainfall, 1905. On the Distribution of Rain in Space and Time over the British Isles during the Year 1905. **By Hugh Robert Mill.** Vol. XLV. London, 1906. 8vo. Pp. 271.

The annual volume on *British Rainfall,* for many years issued by the late G. J. Lyons, and now carried on by Dr. H. R. Mill, is well known the world over to all geographers. The unique rainfall organization started by Mr. Symons continues to carry on its excellent work without Government aid, although the results obtained by the 4,000 and more observers are constantly used in all kinds of public and private undertakings, lawsuits, and the like. We regret to note that "for the last two years the cost of collecting the returns, paying assistants, observers in remote localities, rent, stationery, printing, postage and the innumerable minor expenses, has exceeded the income from subscriptions and the sale of publications; and so far from there being any surplus available for the remuneration of the Editor, he has been obliged to divert time from a work on which he would gladly concentrate the whole, in order to make up the deficit and earn his own living." Dr. Mill's self-sacrificing devotion to his work on *British Rainfall* deserves and receives world-wide recognition among his colleagues in meteorology. We thoroughly agree with Dr. Mill that "such a state of things cannot be accepted as satisfactory," and we hope that some permanent financial basis for the work may soon be established. Part I of the present volume contains two original articles, one on Dr. Hellmann's recent report on precipitation in the North German river basins, and the second on the relation of evaporation to other meteorological phenomena. In the second part we note the admirable discussion of heavy falls of rain, in their distribution over the country and in their relation to cyclonic control, with several maps. The emphasis on the cyclonic unit in the compilation of rainfall data is one of Dr. Mill's important annual contributions to meteorology. R. DeC. W.

Cold Waves and Frost in the United States. By E. B. Garriott, U. S. Department of Agriculture, Weather Bureau. Bulletin P. Washington. D. C. 4to. 1906. Pp. 22. Charts 328.

A valuable collection of weather maps of selected cold waves and frost periods in the United States from 1888 to 1892 inclusive, together with a chronological account of historical cold periods. These charts are in a convenient form for reference and class-room use and are deserving of careful study. No attempt at exhaustive discussion of this large body of material is made in the brief chart which accompanies this Bulletin. R. DeC. W.

Regenkarte von Deutschland. Mit erläuternden Bemerkungen. Im amt--lichen Auftrage bearbeitet **von Professor Dr. G. Hellmann.** Berlin, 1905. 4to. 2 pp. and chart.

Dr. Hellmann has for several years been making a special study of German rainfall, and has been issuing a series of special rainfall maps of different provinces of Germany. The present chart, with two pages of text, relates to the whole country, and will be found of convenient size for use either on the desk or in the class-room. The name of the publisher, Reimer of Berlin, is sufficient guarantee that the chart is in every way of the highest standard. The data relate to the period 1893-1902, and are from 3,000 stations. About one-half of the stations had complete records for the ten years; in the case of the others, reductions to the same period were made. The chart shows the mean annual rainfall in twelve shades, and the base-map is purposely encumbered as little as possible with rivers and towns. The chart is brief and to the point; gives a general summary of the rainfall conditions of the country as a whole, with a tabulation of some of the maximum and minimum annual rainfalls noted in the various provinces. It would be a great help to teachers and students of climatology if rainfall maps as excellent and as easy to handle as the present one were available for more countries. R. DeC. W.

The Climate of Alaska. By Cleveland Abbe, Jr. Professional Paper No. 45, U. S. Geographical Survey. 4to. Washington, D. C., 1906. Pp. 133-200.

For years there has been need of some definite information concerning Alaskan climate. Scraps of climate material have found their way into print; several times the contributions have been a good deal more than scraps, but on the whole there has been widespread misapprehension regarding the special and very interesting meteorological conditions of our great northwestern Territory. The inclusion of a report on *The Climate of Alaska* in the general report on the physiography and geology of Alaska published by the U. S. Geological Survey was logical and fitting. The task of reducing the records and putting the results in a form suited to general use was entrusted to Dr. Cleveland Abbe, Jr., who both by inheritance and training was well fitted to carry out the work satisfactorily. His association with Professor Hann, at Vienna some few years ago, naturally and fortunately resulted in Dr. Abbe's becoming an active advocate of more rational and more scientific methods of discussing climatological data in this country.

The present report summarizes the most important results of the observations made subsequent to the publication of Dall and Baker's work in 1879, the material being collected from the manuscript records covering the period 1868 to the present time. Obviously, many of the observations at the Alaskan stations were in many cases less accurate and less systematic than is expected at stations in more thickly-settled territories, with a more effective organization to oversee the work, but our author has used great care in correcting and culling out his data. He wisely adds:

> (p. 136) it may be stated that the means given are based upon a series of observations of such varying lengths from station to station that they should be used only with the greatest caution.

Alaska is divided into eight climatic provinces which are closely coincident with the physical provinces. A clear, concise account of the *General Climatology of Alaska* (written in co-operation by A. H. Brooks and Dr. Abbe) is followed by a discussion of the climatic features by provinces, and the general tables. A valuable addition to the usual run of climatological tabulations is the series of special tables (pp. 177-188), in which the most frequently-recurring values of certain climatic elements are discussed for Killisnoo, Sitka, and Coal Harbor. A tabulation of rainfall records ends the report.

Space fails here to give any summary of the main features of Alaskan climate as set forth in this publication, but we may note our satisfaction at seeing so much emphasis laid on the relation of the climate to vegetation and to man's interests generally, and at finding Hann's suggestions followed in so many particulars. R. DeC. W.

Advanced Geography. By Charles F. King. xxv and 288 pp., 687 Illustrations, Reference Tables, Index and Pronouncing Vocabulary. Charles Scribner's Sons, New York, 1906.

The criticism of a general and advanced text-book of Geography involves a consideration of the content of the science of Geography. It seems necessary to forewarn the reader that comparison with other books in the same field is regarded as of doubtful value in ascertaining more than the relative worth of a new book. It is granted that King's Advanced Geography is a larger text, contains more illustrations, treats subjects more fully than its immediate predecessors in the field. Every one expects that present-day text-books shall be in advance of the older ones. It is pertinent to inquire as to the nearness of approach to an ideal this Geography represents.

King's insistence on the study of types is certainly commendable, and in this respect the book leaves little to be desired. We believe in the type method, because it gives opportunity for description that is full enough to arouse enthusiasm in the student. The specialist, writing from the stand point of pure science, often wholly misjudges the point of view of the elementary student, looking out at the world with interest, and persisting in no effort voluntarily except as interest leads. It is said that the master of modern geography, Friedrich Ratzel, was early directed into the study of geography through the interest awakened by bright landscape descriptions. Even the specialist of to-day is forced occasionally to let his beautiful valleys and splendid mountains reflect their glories on the pages of his manuscript. One can be scientific and yet human, and while high achievement is sought in the advanced phases of the science, it would also be well to commend those scenic aspects which stimulate one's imagination and fire one's zeal.

The book contains an unusually large number of illustrations. But if Geography is considered as the relation between the earth and life it would be appropriate to inquire of each illustration in the text: What geographic relationship does this express? What response is here exhibited to physical circumstance? Judged by this standard many of the illustrations are superfluous, and merely detract from the value of those which are expressive of this fundamental principle of the science. As a picture, an interior view of the British House of Lords is interesting enough; but as geography, we regret to see it encumbering the text. We can understand why a Swiss village, a raft of logs, and an ocean steamer should be represented, but we question the value of a view of the dining room of that ocean steamer. We deplore the effort to stand pre-eminent in the matter of many illustrations. We look for a return to fewer illustrations. Enough good ones are exhibited: it would seem that we have well-nigh reached the limit in producing clear, representative views of physical features, industries, commerce, etc., in Grammar School Geographies.

We hope also for the proper expression of isothermal lines. (See Preface and pp. 111 and 196, et al.) For the purposes of the Weather Bureau the reduction of barometric and thermometric data to sea-level is essential, but such reduction for a climatic chart impairs its usefulness. The theoretical sea-level temperatures of mountain regions are not regarded by plants and animals and men—their distribution and activities are controlled by the actual temperatures observed at the earth's surface at actual elevations. Such a map would be complex, it is true, but its value would be increased proportionately.

It seems difficult for authors of geographical texts to get away from some of the old and unfortunate conceptions of geography which included so much interesting but so thoroughly irrelevant data. For example, are compulsory school laws (p. 81) Geography, or are they School Law? Should the fact, related in the following way, that a certain city (p. 77) manufactures screws, fine tools, files, and heavy machinery, be placed in a Geography or an Encyclopedia? There must be *characterization,* but facts should not be added to a characterization simply because they are facts. The description of the city of Pittsburg on p. 94 is almost a model of clear, explanatory description, and might well have served as a type in other cases.

That part of the colour scheme of the physical maps which expresses land relief is attractive, but the colours representing ocean bottom relief are rather unhappy. The deep places on these maps appear as shoals, the shoals as deeps, so accustomed is the eye to the conventional way of expressing increasing depth by the darker shades of blue.

The geographic explorer deserves considerate treatment by the geographic author. He is pushing outward the boundaries of knowledge with courage and enterprise, and among other things is putting mountains and plains and rivers in place of blank spaces on the map. His history is, in part, a history of the evolution of the map, and there is no more commendable way of enforcing this truth than by expressing the limits of knowledge with conventional symbols. The rigorous conditions which, until recently, kept explorers waiting outside the Himalayan mountain wall, and make our knowledge of Central Asia meagre even to-day, can be no better expressed than by the broken drainage lines usually employed. We find in this book, however, that the courses of the Salwen, the Mekong, and adjacent systems are drawn in solid lines throughout, as if our information regarding these streams were complete. Likewise drawn are the tributaries of Lake Tchad, notably the Komadugu River of the Sudan, while the wadies of the Sahara are sketched with an unusual degree of boldness.

It is not intended to convey the meaning that other texts are not deficient in the same respects, or that there is any unusual number of defects in this work. On the other hand, we emphatically state that the book is one of the most valuable texts that could be found on a grammar-school teacher's desk. In short, it would be quite unfair to regard the above criticisms from any other standpoint than that of the fundamental conception of Geography.

It is a pleasure to say that Mr. King has a descriptive style equalled by few geographic writers, especially in its adaptation to the needs of elementary students, and for this, and for the clear elucidation of geographic types, the book constitutes a real and noteworthy contribution to Geography. Like King's Elementary Geography, the book is indespensable to every teacher of the subject.

I. B.

Das Königreich Sachsen in Wort und Bild. Mit Unterstützung und unter Mitarbeit zahlreicher Behörden, etc. Herausgegeben von Leo Woerl. xv and 558 pp. Plans of the Cities, 240 Illustrations, a Map of Saxony and Index. Woerl's Reisebücherverlag, Leipzig, 1906. (Price, M. 4.)

The fourth of this series of guide-books, which has achieved well-deserved popularity in Germany, both among tourists from abroad and the native population. Being only 4½ by 6 inches in size, the book readily slips into the pocket. It is compiled on a rather original plan. It condenses into 26 pages a geographical description of the kingdom and gives an idea of its trade, industries, communications, and history. It gives a few pages to each of the leading cities, but prints excellent maps of them and calls attention to all their attractions and amusements. The peculiarity of the little book is that it takes in hundreds of smaller places, tells what they amount to and what their special interests are, points to roads or by-ways where a stroll or a drive may be enjoyed, or that may lead to some old castle, church, storied ruin, or picturesque outlook; and there are scores of small pictures, many of them photographic reproductions of these numerous things that are most enjoyable to see if the traveller has sufficient time to go into a little detail in his wanderings. Such a book may be made especially interesting when written about a country like Saxony, where a great deal of interesting history attaches even to some common objects. This guide-book seems to be peculiarly adapted for automobile, bicycle, or driving trips through the country. The fine map of the kingdom (in pocket) seems to show every hamlet in Saxony, with the roads leading to it.

Studies of the Philippine Tribes.—The latest studies of Philippine tribes are embraced in Vol. II, Parts 2 and 3, of the Ethnological Reports, which contain, first, a paper by Otto Scheerer on the grammar and vocabulary of the Nabaloi dialect of Benguet, among the mountains of northern Luzon near Lingayen Gulf. The tribe speaking this dialect is the Ibaloi Igorot, and numbers about 15,000 souls. The discussion of the dialect fills nearly 100 pages. This is followed by a short report by Edward Y. Miller on the Bataks of Palayan, who number only about 600 persons and live among the mountains of that island. They resemble somewhat the Negritos, but seem more like the description of the wild inhabitants of the interior of the Malay Peninsula. They have long, kinky hair and thick lips, and some have hairy faces and bodies. They are small in stature, but well formed. They do not cultivate the soil except to set out a few edible roots, and in some places they plant small fields of rice. The report gives considerable information concerning this little-known group. Both reports are illustrated by numerous photographs.

Les Combattants Français de la Guerre Américaine, 1778–1783. Listes établies d'après les documents authentiques déposés aux Archives Nationales et aux Archives du Ministère de la Guerre. Publiées par les soins du Ministère des Affaires Étrangères. Senate Document No. 77, 58th Congress, 2d Session. 4to. Washington, Imprimerie Nationale, 1905.

This interesting volume is a reprint of the record published in 1903 by the French Ministry of Foreign Affairs, together with an English translation of the preliminary text, made by the editor, Col. Ch. Chaillé-Long.

The lists are in two parts: the first giving the names of the officers and men in the French squadrons under d'Estaing, de Grasse, de Guichen, and de Ternay; the second those of the land forces under Rochambeau, classified by regiments. An alphabetical index closes the work.

It is to be noted that the list is incomplete, for the navy as well as for the army, many of the documents having disappeared.

The Physiography of the River Nile and its Basin. By Captain H. G. Lyons. 411 pp., 47 Plates, 2 Appendices, and Index. Survey Department, Cairo, 1906.

Captain Lyons, Director-General of the Survey of Egypt, has in this volume accomplished a most useful geographical work. The Nile has been the subject, for fifty years, of much study. The names of leading African explorers, like Junker, Schweinfurth, Emin Pasha, Baker, Donaldson-Smith, and others, have been closely associated with this study, and the geography of the Nile basin, in its broader features, is now well known. Since the fall of Omdurman in 1898, especially, a great many facts relating to the periodical rise and fall of the river, the quantity of water discharged by the Blue and the White Nile, the Atbara and its tributaries of the White Nile, and detailed accounts of the utilization of the waters of the Nile, have been written. The year 1904 was marked by the exhaustive report of Sir W. Garstin, which was soon followed by that of Sir W. Willcocks. The splendid works of these two engineers related to the water supply of Egypt. Captain Lyons is also an engineer; but he writes from the standpoint of a geographer, a geologist, and a meteorologist. In a word, the utilitarian treatment of the subject has hitherto received more attention than the geographical treatment, although it is admitted that the result of geographical study may greatly assist in the practical development of the resources of the river basin. What Captain Lyons has now done is to describe the hydrology of the Nile in the light of geographical information. His large book is filled with information. He has consulted every writer who has contributed valuable data to our knowledge of the Nile. He has given his authority for every statement derived from sources outside of his own work, and his book is thus a bibliography of the literature on this subject.

He first discusses the Nile basin as a whole, and the general lines of its geology, its climate, and its hydrography. He then shows the part that each of the principal drainage basins from which the Nile draws its water resources plays in the regimen of the whole river system. It is hoped to learn by these means in which direction work may most usefully be done in order to attack the many problems that still await solution.

The book gives a very detailed description of the principal drainage basins, viz.: first, the plateau of the equatorial lakes, which has an average altitude of about 1,300 to 1,500 meters, besides the mountain range of Ruwenzori and the volcanic mass of Elgon, which respectively rise about 5,000 and 2,000 meters higher; second, the water-shed, about 800–900 meters above sea-level, which separates the Bahr-el-Ghazal basin from those of the Congo and Lake Chad; third, the Abyssinian tableland, which is more than 2,000 meters above sea-level; and fourth, the vast tract of country, less than 500 meters in altitude, which extends from the upper reaches of the Bahr-el-Arab in Kordofan and Gondokoro on the Bahr-el-Jebel to the Mediterranean.

The topics are methodically arranged, and the index makes it easy to refer to all places and kinds of information. The book may long be the most complete and best source of information on everything that pertains to the geography and geology of the Nile basin. In a work so crowded with facts it is impossible to give much of an idea in detail of the contents. We will quote, however, this brief paragraph on the geology of the southern part of the Nile basin:

> It is a plateau lying some 1,500 meters above sea-level, and composed of gneiss, quartzite, and schists. The central portion is occupied by Lake Victoria, while the deep fault-valley in which Lakes Albert Edward and Albert lie forms the western portion. Much movement has taken place comparatively recently, and blocks of the plateau have been raised, lowered, or tilted, so that the drainage follows the depressions so formed. As yet the rivers have had no time to deposit or erode sufficiently to give a regular grade to their beds, so that marshes and water-logged depressions still alternate with reaches in which the fall is considerable, and the flow therefore rapid.

Numerous tables and maps illustrate especially the meteorology and geology of the different parts of the basin. It is surprising that in a region which has been so little known as the Egyptian Sudan, Captain Lyons should have been able to bring together such a vast number of statistics and valuable observations. The work is certain to rank very high as a scientific, geographical treatise. The metric system is employed throughout, with conversion tables for those who are not familiar with it; but it is remarkable that nearly all compilers of conversion tables, including Captain Lyons, fail to give the equivalent of square kilometers in square miles. American and British geographers who use maps made in continental Europe have frequent occasion to convert square kilometers into square miles or *vice versa*, and often they have vainly appealed to conversion tables to shorten their labours.

Praktische Suaheli-Grammatik. Nebst einem Deutsch-Suaheli wörterverzeichniss. Von Prof. Dr. C. Velten. Zweite vermehrte Auflage, small 8vo, x and 388 pp. Wilhelm Baensch, Berlin, 1905. (Price, 4 Marks.)

Ki-Suaheli is the *lingua franca* in the whole of eastern tropical Africa, and is useful even in large parts of the Congo basin. The enterprises of white men have become so numerous in those regions that acquaintance with the language is increasingly important. The result is that Ki-Suaheli is now taught in Europe, and the facilities in Germany and in the Government schools of East Africa for studying it are especially excellent. This grammar and vocabulary are adapted both for school use and for self-instruction. Naturally, the book is intended, above all, to serve practical needs; and this fact is kept in view in grammar, exercises, and vocabulary.

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THE VALE OF KASHMIR.

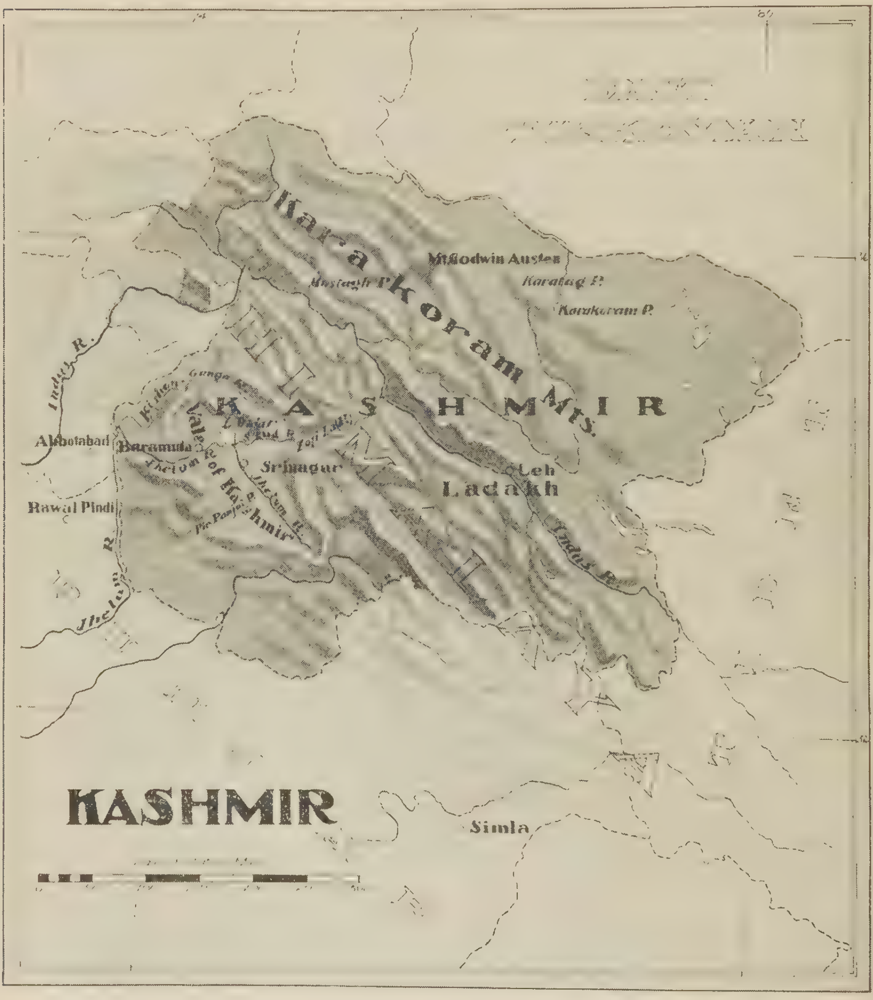
BY

ELLSWORTH HUNTINGTON.

PART I.—THE GEOGRAPHY OF TO-DAY.

The BULLETIN for January, 1905, contained a preliminary notice of the expedition of Mr. Robert L. Barrett *via* India to Chinese Turkestan,—and expedition in which he was accompanied by the author. Our chief objects, as then stated, were the study of "the history of the basins of Central Asia during recent geologic times, and the changes which have taken place since the occupation of the country by man," together with "investigations of the relation of physiography to life, and especially to human life and history." The first subject of serious study was the famous Vale of Kashmir, in the Himalayas, which, with the neighbouring and contrasted region of Ladakh, presents an unusually attractive field to the student of the influence of physical environment upon human habits and character. It also offers some most interesting suggestions as to the possibility that changes of climate during historic times have had a marked effect upon the distribution and habits of man, and hence upon his history and character.

On leaving the warm, low plains of northern India, a six-days' ride (from March 13 to March 18, 1905), in two-story, two-wheeled ekkas, or native carts drawn by one horse, took us north across a low pass about 5,000 feet high in the front range of the Himalayas near Abbottabad and east up part of the gorge of the Jhelum River to the basin of Kashmir. Our first view of the famous valley-plain from a spur a thousand feet above the river was disappointing. Low-lying masses of heavy clouds half hid the lofty encircling ranges of snow-capped mountains; while from the base of the latter flat-topped tongues of piedmont gravel, the tabular remnants of an older, deeper filling of the basin floor, sloped gently down on either side to a point where they were sharply cut off by low river bluffs. Between the latter a water-logged plain of ploughed or stubble fields expanded to a width of ten or fifteen miles and extended indefinitely to the southeast. A large lake to the north, occasional smaller expanses of leaden water, and a dark-brown river flowing in a serpentine course from southeast to northwest completed the view. It was interesting but not beautiful, and hence was disappointing. The tops of the magnificent snowy mountains, rising to heights of 15,000 to 18,000 feet on every side of the plain, were wholly concealed



by clouds, and the verdure for which the vale is renowned had not yet appeared. Northeastward from our hilltop the plain soon came to an end where the front range widens and joins the more northeasterly main range; but to the southeast it stretched away ninety miles towards the head waters of the Jhelum, where the two ranges again join, after separating to a distance of nearly fifty miles from one snowy crest to the other.

The Jhelum River, after meandering northwestward through most of the plain, enters the shallow lake of Wular, twelve miles in diameter, at the base of the northern range, and then, on its exit, turning southwest, flows ten miles to the foot of our spur, where it enters the front range at Baramula. At first, in its course through the latter, it runs forty miles westward diagonally across the northern foothills of the front range, and then thirty miles northwestward along the base of the latter in a deep, picturesque mountain valley broad enough to allow a road and a few villages at its base. At the mouth of the Kishen-Ganga River, however, which comes down southwestward from the lofty main range, the Jhelum suddenly turns south, and for fifty miles flows transversely across the front range in a gorge so deep and narrow that the famous Murree road is obliged to leave it and climb 5,000 feet over a pass in order to reach Rawal Pindi, a few miles west of the point where the river emerges on the main southern plain. The Jhelum, like the Indus, seems to be an example of a river which has preserved its course unchanged since some far past time when the country was much flatter than at present. Now, however, it has sawed its way deep into the heart of a strip of country fifty miles wide and hundreds long which has been warped up along its course, forming the front range of the Himalayas between the elevated basin plain of Kashmir to the northeast and the low plain of the Punjab to the southwest.

As we descended from our hilltop and reached the brown grassy slope half a mile from Baramula, five or six men, armed with portfolios, converged threateningly upon us. One, suggesting a policeman, brandished an official-looking document; a second waved a photograph; a third held a drawing like the plan of a steamer; and the others carried open letters. They all thrust their papers into our unwilling hands, and, in the broken English now spoken by many natives of Kashmir, shouted in rivalry, "Master! master! read this!" "This my boat; very best boat. Twenty rupee." I got best boat. I am six men." "Come, master, see my boat!" In spite of protests, they escorted us to the village, helped us through the mud six inches deep, led us between the two-story wooden houses with their pyramidal thatched roofs green with grass, and brought us to the collection of houseboats on the muddy river. We thought of the jolting of our carts, and of what would await us when we left them at Srinagar, the capital, either a poor and expensive hotel or its alternative, a wet camp with no proper servants, and speedily yielded ignominiously to our captors. We engaged Subhana Benares, who claimed to be six men, together with his father, four brothers, a sister, two wives of some of the family, a modest houseboat with four small rooms roofed with reed-matting, a smaller kitchen-boat where the natives were to live and cook, and a rowboat, for all of which, including people and boats, we were to pay thirty-five rupees (eleven dollars and twenty cents) per month. Other expenses were correspondingly low, even though Subhana considered it necessary for his two "Sahibs" to have five or six pounds of "soup-meat" per day and other articles in corresponding amounts. We noticed that there was much to "throw away," and that our retainers seemed to be very well fed. Nevertheless, our seventeen days in a houseboat proved economical, though also, I regret to say, rather cold and uncomfortable, because of the time of year.

The first view of Kashmir from the Baramula spur and the experience with the houseboat impressed upon us many of the most salient features of the country. First among these is its isolation from the rest of the world by a ring of lofty mountains, unbroken except by the narrow gorge of the Jhelum; next, its great elevation of 5,000 feet and consequent comparatively cool climate, warm and damp from June to August, though but little rain falls, mild and delightful in April, May, September and October, and cold and snowy in winter, so as to be not only bracing but at times rigorous. The nature of the climate gives rise to another characteristic feature—namely, a superabundant water supply, derived partly from a precipitation of about twenty-five inches, mostly snow, on the plain, and much more from the heavier snow-fall and summer rains of the surrounding mountains. The smooth plain of fine rich soil, easily cultivated and easily flooded, presents another salient feature—one which owes its origin to the character of Kashmir as a basin deeply floored with fluvial deposits. A fifth feature is the beautiful scenery of the snow-capped mountains and green lower regions, which, combined with the temperate climate, makes Kashmir the most attractive of summer resorts for the people of India, chiefly the English; lastly, numerous terraces and deposits of gravel indicate that the region has been subject to varying climatic conditions in the not far distant past. Each of these features meets with its appropriate ontographic response in the habits and character of the people. Some of the more interesting responses will be considered in this article; but a much larger number must be left untouched, for the study of geography as the science of the relation between earth and life is as yet so undeveloped that many, perhaps most, of the responses of living creatures to their environment have not yet been correlated with the physical features to which they owe their origin.

Kashmir presents one of the best opportunities for the study of the relation of man to his surroundings, for from the earliest-known times the basin has been occupied by a single race. The people are Aryans allied to those of northern India in blood and language, but far less subject to outside influences because of the high mountain barrier, which has not only made invasion a rare occurrence but has restricted external trade and migration. Hence they have been largely left to work out their own destiny in response to whatever racial characteristics they originally brought with them, modified by the influence of religion and other introduced ideas on the one hand, and of physical environment on the other. Three religions have prevailed successively—Buddhism, Brahmanism, and Mohammedanism—each of which has doubtless had its effect. Nevertheless, according to Stein, the chief authority on the history of Kashmir, the character of the mass of the people seems to have changed but little since the Buddhist days thirteen centuries ago, when the keen Chinese pilgrim Hiuen Tsiang described the Kashmiris as "light and frivolous, and of a week, pusillanimous disposition; handsome in appearance, but given to cunning; fond of learning, and well instructed."

In response to the height and difficulty of the passes across the mountain border of his plain, the Kashmiri has not only been comparatively little troubled by the visits of either enemies or friends, but has rarely gone away from home, either for war, trade, or settlement. The result, as several writers have pointed out, is that he is cowardly, exclusive, and suspicious. Till lately he has hated and feared the few foreigners whom he has seen, and has suspected them of designing evil against himself; and, naturally, has tried to keep them out. The cowardice of the Kashmiri outside Kashmir is proverbial, and at home it is laughable. Several times in the street when I met men and unexpectedly turned on them or asked them questions, no matter how mildly, they started and trembled as though threatened with a pistol; and this is said to be a common occurrence. Mr. C. E. Biscoe, head of the large schools of the Church Missionary Society, which even the natives generally recognize as the best in Kashmir both as to education and as to character-building, told me that when compulsory exercise was first introduced, the boys, chiefly Brahmins, with a lesser number of Mohammedans, were abjectly afraid of the water, though they had lived beside it all their lives. In order to make them learn to swim it was necessary simply to throw them into the canals. Now, however, they have learned to do fine work both in and on the water, and during the last great flood, which half submerged Srinagar, saved much property and some lives. To be sure, they are still cowardly; but there has begun to be a school spirit which makes them ashamed to show their fears. Similarly, in football the boys at first ran away from one another; but now many of them stand up pluckily and run the risk of getting hurt, which shows that though isolation may have made the Kashmiris cowardly, they have a certain amount of moral fibre capable of cultivation.

Exclusiveness was carried so far in Kashmir in the Middle Ages that practically all foreigners were kept out, just as has more recently been the case in Tibet, perhaps for similar physical reasons. Even to-day, in spite of the incorporation of Kashmir in the British Empire, the old ideas prevail so far that no foreigner can remain in the Vale without a permit—renewed, I believe, annually; nor can a foreigner buy or build a house or own land. Natives, or the native Government, build to order. That is one reason why houseboats are so common; for in a boat not only does the landlord become one's servant, but one can move about freely. To people who are on the outside and want to get in, the seclusion of Kashmir seems a bad quality; but it has at least one advantage. Drew* relates how, on the Pir Panjal pass, to the south of Kashmir, at an elevation of 11,400 feet, he "found the ground and the snow for two or three miles' distance strewn with dead locusts [a pest on the plains to the south], which about the middle of May had been destroyed by the cold in an attempted invasion of Kashmir."

The climate of Kashmir is comparable in some respects to that of the northeastern part of the United States, although the sun is hotter, because of the more southerly latitude; the summers are more trying, because the heat is more rarely interrupted by showers and cool storms; and snow falls earlier in the autumn, because of the great altitude, so that the crops are sometimes ruined by it. The first day of our stay in Kashmir (March 19) was warm and clear. Our boat was being towed slowly eastward up the river by the boys and girls of our native family, who trudged barefoot along the towpath at the rate of less than two miles an hour. A stroll on shore in the bright sun among thatched houses surrounded by orchards or beside broad pools, with glimpses of hunters shooting waterfowl with huge blunderbusses, and a clear view of the wonderful ellipse of snowy mountains encircling the plain, made us realize that Kashmir can be idyllic. Most of our twenty-two days in the basin, however, were cold and raw, with several frosts and a little snow, so that we sympathised with the natives who went about with "gungris" under their long, dirty, white cotton gowns. The "gungri" resembles a large flower-pot made inside a wicker basket, with a protective wicker handle, like the arches of a half dome. When filled with live coals it serves to warm the hands—or, oftener, the whole body—by being put under the loose outer robe of either man or woman and held over the stomach whether the people are walking or sitting. It is essentially a lazy man's device; for no one can hold it and work, and it reflects the habits of the Kashmiri, especially of the farmer, who in the snow and mud of winter has nothing to do.

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*Jummoo and Kashmir, p. 158.

The abundance of the water supply of Kashmir and the smoothness and softness of the fine-soiled plain have led to the formation of an intricate network of deep, slow-moving waterways, partly natural and partly artificial, difficult to ford but easy to navigate, and often overflowing. Hence, as Stein points out, the roads are very bad; and as outside traffic is largely shut out by the mountains, beasts of burden are rare, wheeled vehicles are practically confined to the single new thoroughfare down the Jhelum, and traffic is carried on in boats, the loads being usually carried for short distances on men's backs. Almost every village is said to have its landing-place, either close at hand or a mile or two away; and in Srinagar the crowded river and the larger canals are the main thoroughfares.

Another effect of the abundant water and fine-soiled plain, together with the hot summer sun, is great fertility, causing food to be plentiful and cheap. Rice is naturally the chief crop; and though other grains grow well, they are of secondary importance. The water-chestnut, shaped like a pair of stocky cows' horns and dredged from the bottoms of the streams; many kinds of greens and vegetables, of which great quantities are eaten; and fruit, especially apples and pears, are other profitable crops. Cheap food may be a blessing, but in Kashmir one is inclined to doubt it. It seems as though the ease with which a living can be made were the chief cause of the reputed idleness and laziness of the people; and laziness, aided, perhaps, by the opportunities for dishonesty afforded by the large amount of local traffic and barter which the abundant waterways foster, may be responsible for much of the untrustworthiness which is said to be so prominent a trait of the Kashmiris. In this respect the latter are like the people of many parts of India; though they are not so lazy, perhaps, by reason of the invigorating winter climate of their mountain home.

Our own life during the two weeks which we spent in Srinagar in our house-boat was a direct response to the abundance of water, the smooth plain, the fertility of the soil, and the consequent cheapness of the necessaries of life. Like most travellers to Kashmir, we lived in a leisurely fashion. The snow on the passes delayed our start across the mountains, and the slowness of the people prevented haste of any sort. We enjoyed the quaint wood or brick houses, with their green grassy roofs, the orientalism of the narrow, dirty streets, and the busy life of the pleasanter canals. We went sight-seeing in our own "shakari," or flat-bottomed boat, with three or four oarsmen. Brahmins squatted naked on frosty mornings while they bathed at the foot of steps leading to little temples with high, top-heavy silvered domes; market women passed down the canal with boat-loads of spinach and turnips from the floating gardens in the Dal Lake, mere rafts of water-plants strewn with a little earth; merry children in twos or threes sang musically at the tops of their voices; and men clothed in dirty white walked briskly along the embankments beside the canals under the fine bur-covered chenar trees just as old Hiuen Tsiang reports them to have done long ago. Except for the fast walking—fast compared to that of India—the general appearance was leisurely. The Kashmiris, as has been said, have a reputation for laziness; but when I watched them working they seemed to show a good deal of energy and steadiness, though perhaps it was only to keep warm. Along the canal where we anchored, at least a dozen houseboats were being built for the accommodation of summer visitors, and all the timber was sawed into planks on the spot by hand. The men who worked the big saws, one at either end, kept at work steadily, though the labour is tiresome, and twice during ten minutes I noticed that when one of a pair had to stop for something his comrade went and helped some one else.

Within the last few decades a new factor has entered into the geographic development of Kashmir—namely, the attraction exercised by its climate and scenery upon the British sojourners in India. The æsthetic element of love of scenery and the rational element of choosing a place for a home for the sake of its favourable climate, though strictly geographic factors, exist only in highly-civilized communities. Therefore, in the past they have been of small importance; but as their significance is more and more appreciated, it is probable that they will exert a growing and even a preponderating influence upon the distribution of intelligent people in countries not blessed in general with the invigorating climate of the cool Temperate Zone. To-day, for instance, India is governed from the small hill-station of Simla rather than from hot Calcutta; and retired Indian officers and civil servants who cannot return to England are beginning to see in Kashmir a place where it is possible to settle permanently in spite of the restrictions imposed by the native Government. Already the great influx of summer visitors has caused a considerable number of Kashmiris to become servants or keepers of houseboats; a distinct impetus—not always beneficial, because it encourages the use of cheaper, less durable, dyes—has been given to the highly-developed native arts of rug-weaving, shawl-making, and embroidery; and the merchant class, though always noted for their habit of fastening on a victim, have become more rapacious than ever. Indeed, the merchants are the bane of the foreigner's life in Srinagar. They come in boats and on foot; in the guise of beggars and of princes; before sunrise, at noon, and at night; they dog one if he goes for a stroll; they sit on the bank and wait for hours to pounce upon the chance visitor. When we first tied up to the bank of the canal in Srinagar, Subhana (our factotum) suggestively laid by the door a little willow cane which might have served as a whip, and, in answer to our inquiries, remarked laconically, "For merchant." He evidently appreciated two national traits—the choleric temperament of the British officer from India and the impudent persistence of the otherwise timorous Kashmiri merchant. A typical specimen of the latter stood on the muddy shore one day as I sat on deck in the rare sunshine, and, holding up a gaudy red felt, began:

"See, master, here numda [felt] very cheap. Master buy him cheap." No reply from the traveller.

"Only look, master. No buy; only look." A pause. "You wanting other kind felt? I bringing him, very best." Still no reply.

"I good man, master, honest man. Read my letter," (holding out a well-thumbed bunch wheedled out of every foreigner whom he had ever cheated). "Only read, master. I not like other man. I good man."

"No, put them up; I don't want your felts," I answered at last.

"I got boots, master," trying a new tack. "I am leather man. I new man. I no been here before, master." He had been there an hour a day for three days, had tried to intercept us as we went to make a call, and had shouted to us from the bank as we rowed down the main canal.

Long interval broken only by such remarks as "Very good," "Cheap," "Only look," "Oh, master, look!"

At last a new effort, "What time you say I coming to-morrow morning? Eight o'clock? Very well. I bringing many shoe."

Half an hour of this sort of thing made me regret that the cane had been put away.

The problem of transportation furnishes another illustration of the influence which the invasion of Europeans in summer is having upon Kashmir. On leaving Srinagar on our way to Ladakh or Little Tibet, two hundred miles eastward across the main range of the Himalayas, we first spent a delightful spring day in floating slowly ten miles westward down the Jhelum and in being towed still more slowly seven miles northward up the tributary Sind to the head of navigation at Gunderbal. There we dismissed the houseboat; and then for two short stages shaggy little ponies, secured as a right from the villagers by means of a pass from the British Resident at Srinagar, carried us eastward up through the lovely scenery of the Sind Valley—among spreading walnut trees (often used as hay stacks), among mossy rocks, dashing brooks, and straw-thatched houses. On April 6, at an elevation of about 7,000 feet, we encountered snow too deep for horses, and were obliged for nine days to walk and have the load carried by coolies. When the first detachment of men was being procured at Gund a great uproar in the muddy courtyard called us out from our smoky, windowless room to the second-story balcony among the cows which ambitiously mount the broad stone steps. In their usual fashion, the Chief Men of the village were delaying matters because snow was falling and the road might be bad. Our headman, a remarkably trustworthy and energetic Mohammedan from Ladakh or Little Tibet, had knocked down one village official into the mud and had beaten another with a stick. Nobody seemed resentful and nobody stopped talking. Apparently they looked upon violence as the logical result of their obstructiveness; but not enjoying it, they speedily gathered the necessary band of thirty-five coolies. The latter did not want to go. Who would, if he had to carry a sixty-pound load over roads where even the unloaded "Sahib" grows weary? For six days the same band of coolies trudged through the deep snow, getting the grass sandals on their bare feet soaked with rain and slush the first day, picking their way perilously among old avalanches with new ones roaring all about them the second, burning and blistering their faces in the intense heat and dazzle of the succeeding clear day, and on the fourth, after a night in a rest-house full of smoke, tramping over the hard, smooth crust in the clear light before sunrise to the top of the Himalayan pass of Zoji La, 11,300 feet above the sea.

The men's wages, according to the official scale, were eight cents a day, except for especially hard stretches, where they got ten. As nothing is ever paid for the return journey, four or five cents a day was all that they were entitled to for the most exhausting labour; but the means of supporting life in Kashmir are so cheap that with this they were able not only to pay for their own food, chiefly bread and rice, but to support their families. In spite of their unwillingness to go, the men seemed cheerful in their stolid way, and chattered like magpies when they came in for the night. A present of a little tea all around made them quite jovial.

The bearing of burdens by coolies is a necessity if communication is to be kept up among the snowy mountains of Kashmir; but its influence is distinctly bad, encouraging brutality and violence on the part of employers and engendering deceit, laziness, and selfishness in the men-of-burden. Our coolies engaged in regular fights for the lightest loads, and some of the more clever ones constructed mock loads by wrapping a rope or some other light, bulky thing in cloth and staggering off with it. Nothing but Government compulsion could make them do the work except for exorbitant hire, although they are accustomed to carry their own loads on their backs. If the people should become more educated or more independent, they would refuse to act as coolies, and some new means of transport would be necessary. Among the changes which will in time come to Kashmir the introduction of a new system of transportation among the snowy mountains may perhaps be reckoned; for, on the one hand, education is beginning to spread, though as yet it is largely limited to the cities, and, on the other, the demand for coolie labour and the disinclination of the people to perform it are increasing with the growing invasion of Kashmir by English tourists and sportsmen.

The old order is passing away in the Vale of Kashmir, and it may not be long before the simple geographic conditions produced by the long and undisturbed residence of a homogeneous race in the seclusion of their mountain-girt basin will give place to the complexity arising from the mixture of races and the invasion of new habits and ideas. Since the opening of the new wagon-road down in Jhelum, external trade and intercourse of all kinds have received a powerful impetus; and when the projected electric railroad, run by power from the Jhelum, is completed, the isolation of Kashmir will be largely destroyed. Pronounced changes in trade, and in the distribution, habits, industries, and even character, of the natives, together with the development of a new and relatively permanent English element of population, are likely to follow; and the Kashmir of the future will be much more complex than that of the past.

PART II.—THE CLIMATE OF THE PAST.

In geographical and historical works it is generally assumed that at least as far back as the beginnings of written history, the climate of past times has been practically uniform. The basis for the assumption is largely a matter of opinion, without definite proof one way or the other. In the desert regions of northern Africa and western and central Asia, there are many places where the water supply of antiquity, as indicated by the size of ancient ruins and lakes, or by the amount of former vegetation, appears to have been greater than that of to-day. The phenomena have usually been explained on the hypothesis that the apparent decrease in the amount of water is due to human factors, such as the abandonment of irrigation works because of war, misgovernment, or disaster, the cutting off of forests, and the diversion of rivers from one region of irrigation to another. A second hypothesis holds that, even though there be no change of climate, deserts by their very nature must continually expand, eating up or corroding, as it were, the habitable areas on their borders. A third hypothesis postulates local changes of climate which affect only small areas and, so far as the hypothesis is concerned, are unrelated to each other or to any generally-known processes or events. Lastly, according to a fourth hypothesis, which I have set forth in the Reports of the Pumpelly Expedition,* and in an article recently published in the *Geographical Journal*, the climatic changes which characterized the Glacial period have continued with decreasing severity down even to the present day. Other evidence, which is shortly to be published, suggests that, while the general tendency from early historical times onward has been more or less rapidly toward greater aridity, there may have been at least one period of partial recovery during which the withering rivers of desert regions increased in volume and length, vegetation became more abundant, and the advance of deserts was checked or reversed for a time, only, however, to begin again when the climate once more tended toward aridity. Stated more concretely, but with the proviso that the statement is highly tentative, the hypothesis may be expressed as follows: The facts at hand in the drier regions of western and central Asia suggest that during the last few thousand years the climate has gradually become more arid. The general tendency toward aridity appears to have been accentuated by an unusually dry epoch somewhere in the first thousand years, more or less, of the Christian era, after which it was probably interrupted by a slight mediæval increase in humidity or cold, although at present a tendency toward aridity again seems to prevail. The inferred changes of climate are of especial significance because they seem to have coincided with and to have been the cause of some of the chief events of history.

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*Exploration in Turkestan. Publication No. 26 of the Carnegie Institution of Washington, Washington, D. C., 1905.

In the present article it is not possible to examine the four hypotheses, or any one of them, in full. I propose to investigate the question of whether there is any evidence of changes of climate in Kashmir, or whether all the facts can be explained as consistent with an unchanging climate. If the answer affirms the probability of changes, further inquiry becomes necessary in order to decide between the third and fourth hypotheses—that is, as to whether the supposed changes have been local or widespread, a question which can be answered by a study of the extent of the agreement of details in far-separated regions. Previous discussions of the climate of antiquity have dealt almost exclusively with arid regions. Kashmir, on the contrary, is a comparatively moist region, with abundant vegetation, and hence any evidence which it may present is of unusual value.

In arid regions the types of evidence upon which the hypothesis of an historic change of climate is based consist of various classes. One class, dealing with the relation of climate to life, includes, on the one hand, ruins of ancient cities and irrigation works in places where there now appears to be no sufficient water supply; and, on the other, extensive areas of dead or dying vegetation. Another class dealing with the effect of increasing aridity upon surface water, includes withering rivers and springs and enclosed lakes inferred to have decreased in size. Still a third class concerns itself with the influence of changes of climate upon the form of the earth's surface. It deals chiefly with fluviatile terraces or other deposits which happen to be so placed that it is possible to ascertain their date with reference to man. A last class consists of the type of evidence found in historic and legendary records. It is evident that in a region like Kashmir, where water and vegetation are still abundant and the rivers and lakes discharge to the sea, the first two classes of evidence can find no place. Our inquiry must be limited to a comparison of terraces and allied phenomena on the one hand with legendary and historic records on the other.

The Jhelum, which, it will be remembered, is the main river of Kashmir, and all of its chief tributaries which I saw—namely, the Kunhar, Kishen-Ganga, and Sind—wherever they flow in well-defined mountain valleys are bordered on either side by a series of fluvial terraces composed of gravel, and rising to a height of five to five hundred feet above the stream. In order to understand the relation of the terraces to the problem of the climate of the historic past, it is necessary to gain a clear conception of their cause. Hence a somewhat technical physiographic discussion is necessary before we can pass on to the human side of our subject. Three hypotheses present themselves in explanation of the terraces of Kashmir. According to one, the terraces may be due to changes in river action, due to the enlarged glaciers of the Glacial period, which scoured out the heads of the valleys so vigorously that the streams could not carry away all the detritus. Hence the bottoms of the valleys were filled with the detritus in the form of deposits of gravel. When the glaciers retired, and the load of the streams was correspondingly lessened, the rivers were able to cut into the gravel deposits in the bottom of their valleys and thus to form terraces. A second hypothesis attributes the terraces to warping of the earth's crust, whereby the streams were at first retarded and caused to aggrade their beds by covering them deeply with gravel and silt, and later were accelerated and induced to deepen their channels and form terraces. These two hypotheses are familiar to all students of physiography. In "Explorations in Turkestan" I have presented a third hypothesis, to the effect that the terraces are due to the changes of climate which gave rise to the Glacial period, although glaciers *per se* had nothing to do with the matter. As the hypothesis is not yet familiar to most readers, and as it appears to fit the facts in Kashmir, I shall devote a few paragraphs to its elucidation after showing why the other two hypotheses are inadequate.

The accompanying sketch (Fig. 1) represents the profile of the Jhelum river from near its head, *A*, in the middle range of the Himalayas, across the plain of Kashmir, through the Wular lake, and across the front range of the Himalayas, *C*, to the plains of northern India. The unshaded portion represents the solid rock below the bed of the river. The heavily shaded portion represents deposits of gravel which have been dissected into a terrace; and the lightly shaded upper portion represents the mountains through which the gorges of the Jhelum are cut at *A* and *C*, and which surround the plain of Kashmir. Although the upper surface, that is, the smooth top, of a given terrace on any of the observed rivers of Kashmir descends steadily, as shown in the profile, its height above the stream varies, being greater where the valley sides rise steeply to a great height, as at *A* and *C*, becoming less as the mountains diminish in height and steepness, and being reduced almost or completely to nothing in flat plains, such as that at Kashmir, *B*, where the mountains retire far from the river. If the terraces were due to the erosive activity of glaciers, they, that is the terraces, would be highest at the head of the valley, *A*, close to the glacial source of their component gravels. They would diminish in height downstream toward the plain, *B*; but they could not revive again in the lower range, *C*, where there have never been any glaciers competent to supply the required rock waste or gravel. Hence we conclude that the variation in the height of the terraces above the stream in response to the character of the valley sides, involving their revival to great size after having been reduced almost to nothing, shows that they cannot be due to any cause such as glaciation acting at the head of the valley, *A*, but not among the lower mountains surrounding *C*.

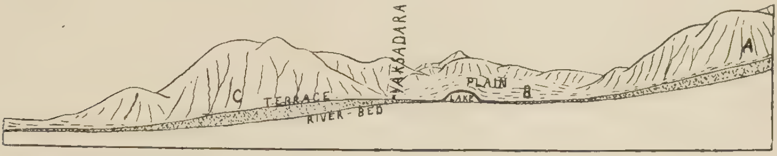


FIG. I—IDEAL LONGITUDINAL SECTION OF THE JHELUM VALLEY.

The possibility that the terraces are due to warping of the earth's crust is not absolutely excluded by the facts at Kashmir, so far as I saw them. It is rendered improbable, however, by the fact that terraces of the same relative size and order are found on independent streams flowing in opposite directions down either side of both the front and main ranges of the Himalayas, and on streams such as the Jhelum and Indus, which flow southward across one or both ranges. If the terraces are due to warping, it means that during the most recent geological times both ranges for a distance of hundreds of miles must have been subject to small up-and-down movements which preserved the same relative intervals and intensity over the entire area. Such a supposition is contrary to the very local and variable character of earth movements now taking place—for instance, the San Francisco earthquake, where the intensity of the dislocation and even the direction varied from place to place. Moreover, earth movements of the past recorded in faults, or dislocations of the earth's crust, usually appear to have involved motion chiefly in one direction, rather than repeatedly up and then down, as must have been the case if such movements are responsible for the alternate cutting and filling seen somewhat among the Himalayas, and still more in remoter regions, where, most significantly, the terraces are almost identical with those of Kashmir.

If we are right in concluding that the terraces cannot be due either to glacial action, or to warping of the earth's crust, the only alternative appears to be that they are due to changes of climate. Such an hypothesis is supported by the uniformity of the terrace phenomena over vast areas. In Persia, Transcaspia, and Russian Turkestan, as I have shown in the reports of the Pumpelly Expedition, the terraces of the main valleys leading from the higher mountains present a marked degree of uniformity in structure, arrangement, number, appearance, and relative size. In north-western India and in Chinese Turkestan, both among the Kuen Lun Mountains on the south and the Tian Shan Mountains on the north, the same is true. From Persia on the west to China on the east the typical series of terraces consists of three which are old and large and comparatively dissected, two which are much smaller, younger and better preserved, and a still smaller one, often absent, which may be called incipient. Sometimes there are traces of one or two terraces older than any of those just mentioned.

We are apt to think of the Glacial period as, primarily, a time of intense glaciation. Such a view is inadequate. Glaciation was a phenomenon whose distribution in space was limited to the northern half of Europe and North America, and to a few elevated regions in other parts of the world. Its distribution in time was limited to the five or more glacial *epochs* which formed half of the Glacial *period*, the other half being composed of *inter*glacial epochs, during which the climate was so far ameliorated that the glaciers retired as far as their present position, or farther. Thus the Glacial period was, primarily, a time of *climatic change*. It consisted of alternating epochs of colder or moister climate on the one hand and of warmer or drier climate on the other. In non-glaciated regions one of the most notable features of the colder or moister epochs must have been an increase in the size of rivers analogous to the increase in the size of glaciers in glaciated regions. Hence, such epochs may fitly be termed "fluvial" when we speak of regions where rivers increased in size, just as they are called "glacial" in regions where glaciers increased in size. The use of the word "fluvial" is advisable in order to avoid the implication of glaciation involved in the more common word. Accordingly, when referring to non-glaciated regions I shall use the terms "fluvial" and "inter-fluvial" and their derivatives as the designations of the contrasted climatic epochs ordinarily known as "glacial" and "interglacial" in Europe and America. The new terms imply nothing as to the cause of the epochs under discussion. The exact cause of the Fluvio-Glacial period is as yet unknown. It may have been due to alternating conditions of relative cold and heat or of increased and decreased precipitation, or of more or less cloudiness, or to a combination of any two or all of these possibilities. In using such terms as moist, cold, humid, dry, warm, arid, and the like, I do not mean to imply anything one way or the other as to the cause of the Fluvio-Glacial period.

Whatever the cause of "fluviation" may have been, it seems safe to say that in non-glaciated regions, such as most of Central and Western Asia, a fluvial epoch was a time of increased humidity, because of either increased precipitation or a diminished evaporation. In either case the size of rivers, springs, and enclosed lakes would increase, and the soil would be more damp than in an inter-fluvial epoch such as the present. Under such conditions the processes of weathering or rock decomposition would be more active. Therefore, in places where the underlying rock was not already protected by a thick layer of soil, weathering would proceed rapidly until such a layer was formed. In regions which are now arid this would be especially true. Under conditions of aridity, plants are so scarce that the soil is not held in place, even on very gentle slopes. It is washed away by occasional torrential rains almost as fast as it is formed. Increased humidity would cause an increased growth of vegetation, the roots of which would be effective agents in holding in place the new soil and half-decomposed rock produced by the more rapid weathering.

One objection must be met at this point. There can be but little doubt that fluvial conditions would cause a deeper accumulation of soil in regions which are now warm as well as dry. It is conceivable, however, that in regions which are now *cold* and dry, the possibly increased degree of cold might diminish the amount of vegetation so that the thickness of the cover of soil would grow less rather than increase. In certain places this might occur, but not often. Botanists agree that lack of water is far more injurious to plant growth than is lack of heat. The dependence of vegetation upon favourable conditions of moisture rather than of temperature is well illustrated by a comparison of two regions which I saw in Central Asia. The western part of the Tian Shan Mountains in the vicinity of Son Kul (left-hand lake) lies in latitude 42°, eight degrees north of Ladakh in the Himalayas.

Both regions lie at the same altitude of 10,000 to 11,000 feet; and if the moister parts of Ladakh, such as the Dras Valley north of Kashmir, be included, the precipitation is not widely different. But Son Kul is a cold place, where snow lasts eight or nine months, and there are frosts in July; while most of Ladakh has snow for scarcely three months, and is so warm that apricots can be raised, and snow remains for scarcely three months. Yet, when I visited Son Kul as a member of the Pumpelly Expedition, I found that because of the low temperature there was but little evaporation and the ground was very moist. Consequently the mountain slopes in July were covered with a thick protective growth of turfy grass, full of the most delicate spring flowers and dotted with scores of the felt tents of nomadic Kirghiz and with literally thousands of cattle and sheep. As might be expected, the soil, thus protected and held in place, was deep. In Ladakh, on the contrary, in May, as is true throughout the year, the dry, hot slopes were almost naked, and the few sheep of the hardy villagers were browsing on scattered burtse and other sparse plants of the sage type. The disparity between the two places, both as to vegetation and soil, was out of all proportion to the disparity in precipitation. If Ladakh were to become as cold as Son Kul, there would be much less evaporation, and the vegetation would approximate to that of Son Kul. Naturally, an increase of precipitation would cause a similar result. Thus, except in extremely cold regions, a fluvial epoch, whether due to greater cold or greater precipitation, would be a time of more abundant vegetation, which would hold the soil in place.

Let us suppose now that during a fluvial epoch a mountainous country, more or less arid, as the case may be, has become somewhat thickly covered with soil. If now an interfluvial epoch should ensue, there would be an approach toward aridity, even though conditions might not be extreme. Part of the vegetation would gradually disappear, and the tendency to sudden and violent floods would increase. Consequently, the soil and rock fragments covering the mountain slopes would be more exposed to erosion and would be washed down to the valley bottoms. The amount of material thus provided would be so large that the streams would be overloaded and could not carry it all away. Thus the valley bottoms would become areas of deposition. In time, however, the slopes would be stripped of all loose material, or else an epoch of greater humidity would again prevail, and vegetation would increase so as to check the carrying away of the soil. In either case the streams would not have so heavy a load of detritus as formerly, and would begin to cut into the deposits of relatively loose material at the bottoms of their valleys, thus forming terraces. By repeating the processes of deposition and erosion, an indefinite number of terraces might be formed, provided each repetition was less effective than its predecessor, whose work it would otherwise conceal.

The theory which has just been outlined must now be applied to Kashmir. In the gorges of the Jhelum a complete series of terraces is developed. In the plain, however, the two lower terraces are rudimentary or lacking; while the upper ones take the form of "karevas," the long tabular slopes of gravel mentioned in the general description of Kashmir. Their structure is illustrated in Fig. 2, an ideal section across the plain from north-east to south-west. Apparently, at the end of one of the main fluvial epochs, when much loose soil and broken rock had accumulated on the mountains, a more arid interfluvial epoch with a fairly dry summer climate like that of to-day ensued, causing vegetation to diminish somewhat and allowing the weathered mantle of rock to be washed down to the plain, the level of which was thus raised to 1 (Fig. 2). During a succeeding epoch, part of the material thus deposited was cut away by the river, leaving a "kareva," *A*. Probably the process was repeated several times, for in various places, there are traces of three terraces, as we saw on the spur at Baramula, or at Srinagar on the isolated temple-crowned hill of the Takht-i-Suliman (Throne of Solomon), a thousand feet high.

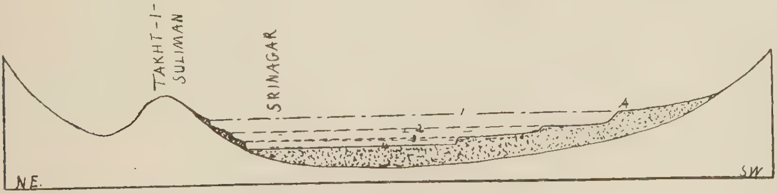


FIG. 2.—IDEAL CROSS-SECTION OF THE KASHMIR PLAIN, SHOWING ITS CHARACTER AS A BASIN PARTLY FILLED WITH FLUVIATILE DEPOSITS, AND ALSO THE KAREVAS, OR TERRACES.

On the side of the Takht-i-Suliman, as appears on the left of figure 2, the terraces are mere remnants, the narrow, steeply-sloping stumps of piedmont slopes composed of fine soil and bits of angular talus derived from the mountain-side behind them. Apparently the "karevas" and the remnants of terraces on the Takht-i-Suliman correspond to the three upper terraces of the gorge of the Jhelum farther down stream, and are too old to have any ascertainable relation to man. They are important, however, because, taken in connection with the terraces of neighbouring streams and with those in other parts of Asia, they illustrate the mechanism of terrace-making, and tend to show that the phenomena were practically identical throughout central Asia, and hence were probably due to a single widespread cause, which appears to have been the climatic oscillations of the Glacial—that is, the fluvial—period.

Turning now to our immediate problem, the relation of climate to man and history, my brief study of Kashmir did not reveal any instances where ruins or other traces of early human occupation are directly associated with terraces in such a way that the one can be dated in reference to the other. Certain legendary and historic accounts, however, seem to indicate that during the last two or three thousand years the conditions of human life have been considerably affected by changes of climate, which appear to be the same as the ones giving rise to the lower terraces. Stein (1899, pp. 65, ff.) relates a tradition prevalent as long ago as the time of the Chinese pilgrim Hiuen Tsiang in the seventh century and recorded in full by Kalhana in the twelfth century. According to it, the demon Jalodbhava (Water-born) resided in a lake which then covered Kashmir. He caused great distress to all neighbouring countries by his devastations. Kasyapa, the father of all fountain-gods, hearing of this from his son Nila, the king of the Kashmir fountain-gods, promised to punish the offender, and proceeded to the seat of Brahma to implore his aid and that of the other gods. His prayer being granted, the whole host of heaven took up their position on the lofty peaks about Kashmir, and ordered Jalodbhava to leave his watery home. This the demon, who was invincible while in the water, refused to do. Vishnu thereupon called on his brother, Balabhadra, to drain the lake by piercing the mountain with his weapon, the ploughshare. When the lake had become dry, Jalodbhava was attacked by Vishnu, and, after a fierce combat, slain with the god's war-disc.

Kasyapa then settled the land of Kashmir which had thus been produced, the gods as well as the fountain-spirits taking up their abodes in it, while the various goddesses adorned the land in the shape of rivers. At first men inhabited the land only during the six summer months, and withdrew to warmer regions each winter, leaving Kashmir during the cold season to the Pisacas, the vilest and most malignant of Hindu demons. At length, however, after four yugas or ages the Brahman Caandradera learned certain rites which freed the country from the Pisacas and from excessive cold; and Kashmir became habitable throughout the year. Stein (1899, p. 66) and Drew (p. 207), two of the most careful writers on Kashmir, regard this tradition as not founded on historical fact, but on inference from the lake-like appearance of the basin and from the fact that during floods Lake Wular is subject to considerable fluctuations in size. It is possible that the legend of an ancient lake, drained by the ploughshare of a god, might rise in this way, but there is nothing in the physical features of Kashmir to give rise to the circumstantial details of the great cold of antiquity, the long prevalence of winter, the occupation of the country by nomads at first during only half the year, and its later change to conditions adapted to agriculture. The circumstantial character of the legend and the agreement of the details with physiographic facts in Kashmir and elsewhere, as will shortly appear, give ground for supposing that the story may be founded on fact.

Another legend, also quoted by Stein (1899, p. 115), relates how, after the drying up of the lake, the site was occupied by a town called Candrapura. A certain holy man coming to the town and being refused entertainment, cursed it and foretold its destruction by water. Later a fountain-god, who visited the country in the guise of an old Brahman, asked and obtained permission to settle in the town, and then out of gratitude revealed himself in his true form and warned the king of the prospective submersion of the city. The king and his people accordingly migrated a short distance westward and, under the god's direction, founded a new town. Then the god took up his residence in the lake, which soon overwhelmed the old city. The natives say that ruins, supposed to be those of this city, have been seen at the bottom of this lake.

Turning now from legend to better-attested history, it appears that Kashmir, now and always, has suffered more or less from famine, due, not to drought, as in so many countries, but to floods, which drown the rice crop. In the time of King Avantivarman, A.D. 855–883, as Stein (1899, p. 108–109), on the authority of Kalahana, relates, Kashmir had long been suffering from peculiarly disastrous floods of this sort and from the general water-logged condition of the country. Many attempts had been made to mend matters, and at last, to quote Stein, "Suyya, a man of conspicuous talents but low origin, offered to remedy the troubles. The operations commenced at Yaksadara, where large rocks, which had rolled down from the mountains lining both river-banks, obstructed the Vitasta (Jhelum). . . . Yaksadara, the present Dyaragul, is a spur projecting into the river-bed some three miles below the commencement of the Baramula gorge. Its rocky foot forms the first rapid of the river (after it leaves the Kashmir plain). By removing the obstructing rocks the level of the river was lowered. Then a stone dam was constructed across the bed of the river, and the latter thus blocked up completely for seven days. During this time the river-bed was cleared at the bottom, and stone walls constructed to protect it against rocks which might roll down. The dam was then removed, and the river flowed forth with increased rapidity through the cleared passage: I must leave it to competent engineering opinion to decide to what extent and at which point of the Baramula gorge the operations so far described were practicable with the technical skill of that age. What follows in Kalhana's account is so matter-of-fact, and so accurate in topographical points, that a presumption is raised as to the previous statements, also resting, partially at least, on historical facts."

Yaksadara, where the operations were carried on, lies directly opposite the mouth of a large stream which, in the ten miles from its source near Gulmarg, descends 7,000 feet. It appears as though, at the time of Avantivarman, the large fan of this stream had encroached upon the Jhelum and raised its level, just as has happened at many other places lower down—for instance, at Uri, where the front of the fan was in later times cut off by the river. The process of cutting off the front of the Yaksadara fan, though begun artificially under the direction of Suyya, probably continued naturally during later centuries; for the level of the Wular Lake appears to have fallen steadily, as though the river were slowly deepening its channel by cutting away the fans and other material in the bottom of its valley, thus forming a terrace. In proof of this fall of the lake level Stein (1899, p. 113) cites certain villages which Kalhana, 1148 A.D., seems to indicate as having been actually reclaimed from the lake, and which Jonajara, *circa* 1450 A.D., still places on its very edge, although now they are three miles from its border. Similarly, Srivara, *circa* 1480 A.D., speaking of the neighbouring villages stretching from Sudarkoth (Sadykoot) to Andarkoth (Andykoot), seems to place them along the shore of the lake, although they are now from four to six miles away. Stein attributes the change in the relation of the villages to the lake to the building up of the delta of the Jhelum, where it enters Lake Wular. This cause, however, though doubtless operative, seems inadequate to produce such great results, especially when it is considered that some of the marshy regions to the south of the lake away from the delta have also become drier. The chief cause is probably the lowering of the level of the lake by the deepening of the outlet channel—a process which has surely taken place not many centuries ago, as is proved by the freshness of that which Stein (1899, p. 116) calls the "winding but well-defined bed" which the river has cut in recent times—and is, perhaps, still deepening—from the outlet of the lake to the head of the gorge.

Putting aside all unnecessary details, the following outline of events appears to fit the legends and facts related in the last few paragraphs. Long ago, in prehistoric times, the basin of Kashmir contained a lake much larger than that of to-day. The lake was partially drained by the deepening of the channel at the head of the gorge of Baramula, where, it should be remembered, the river would encounter only unconsolidated deposits. After this, or at this very time, the climate was so cold, or the winter snows were so abundant and lasted so long, that the country could be inhabited only in summer by nomads who migrated southward in winter. In time, however, the climate moderated, and Kashmir became the abode of a permanent and prosperous agricultural community. At the height of its prosperity a new difficulty appeared. By reason of the building up of the bottom of the gorge near Baramula. the lake began to expand again, and to overwhelm inhabited villages. Many attempts were made to remedy matters, and success was finally attained, after which the river itself was able to deepen its channel, instead of letting itself be checked by the waste brought in by its tributaries.

The size of the legendary lake of the earliest tradition suggests at first thought that the water supply then was larger than at present. According to the theory of terraces, already outlined, however, this is not necessarily the case; the lake would be most likely to expand in a dry epoch. It is not a question of water supply, as in the case of salt lakes in enclosed basins, but simply of how the Jhelum River came to be so checked that a small portion of its superabundant water was detained in a lake. At present Wular Lake is about twelve miles long north and south by about six east and west, and, according to Stein, has a maximum depth of fifteen feet. It is surrounded on all sides by alluvial deposits, which have been built up in such a way as to leave at the base of the northern mountains the faint hollow in which the lake lies. The formation of the broad dam, so to speak, which holds back the lake, may probably be attributed, in part to the deposits laid down during seasons of flood by the Jhelum itself, and still more to the deposition of fans by the tributaries which come in from the north and south near the mouth of the Baramula gorge. In a slightly moister epoch the forces of erosion would be less active upon the mountain slopes, because of their thicker cover of vegetation ; the streams, though large, would not be very heavily loaded, and the tendency would be to cut away the fans and similar deposits which had previously been laid down and to drain the lake. On the advent of a drier epoch, on the other hand, the forces of erosion would be more active upon the mountain slopes, and the average size of the fragments carried away would be greater because of the diminution in vegetation and in the number of roots which would hold the soil in place; the streams, especially the shorter, steeper tributaries, would be not only more heavily loaded, but also smaller; and the valley bottoms, with their comparatively gentle slopes, would become areas of deposition. Where the swifter tributaries joined the slower main stream they would tend to build up fans which the main stream, also diminished in volume and more heavily loaded, might not be able to remove. Thus the fans would form dams ; and, paradoxical as it may seem, lakes would tend to be formed in drier epochs and to be drained in moister epochs. The process would be simply another phase of the terrace-making process already discussed.

If now our conclusions as to terraces and lakes, on the one hand, and the physical history of Kashmir, as inferred from legend and history, on the other, be compared with the interrupted progress of desiccation suggested by the facts in remoter regions, it will be seen that the three lines of evidence agree quite closely. The terraces seem to indicate a succession of climatic oscillations, during the drier phases of which the basin of Kashmir was probably occupied by a large lake which was drained during the moister phases. No absolute proof of such a lake has been found, however; for though Drew and others have thought that the "karevas" —the tabular deposits of silt and gravel already discussed—were lacustrine, recent investigation in other regions has shown that such deposits are usually largely of fluvial origin, though small lacustrine portions are not uncommon. The earliest legend demands a large lake; physiography gives no direct evidence of such a lake, but says that there is a high degree of probability that something of the sort may have been formed during a dry epoch. Hence we may provisionally accept the hypothesis that during the last interglacial or interfluvial epoch of comparative dryness a lake was formed which persisted long enough to be seen by early man.

Evidence as to the succeeding epoch is more definite and more completely in agreement. The legend points to a cold period during which Kashmir was not habitable in winter, and during which the lake which occupied the plain was drained by the cutting of a deeper channel. Physiographic evidence, as we have seen in the discussion of the paradoxical origin of lakes, seems to show that if there were a lake larger than that of to-day, it was probably drained during one of the moist epochs of which the terraces furnish independent evidence. In Transcaspia, Persia, and Turkestan, other lines of research give ground for the hypothesis that two thousand or more years ago the water supply was decidedly larger than now, and the desert regions were more habitable. Putting together all these conclusions, there seems to be reason for believing that a fluvial epoch, culminating somewhere in remote antiquity, had not yet wholly passed away at the beginning of the Christian era, and may have been the time indicated in the legend when Kashmir was too cold to be inhabited, except in summer, by nomads. Even to-day the snowfall of Kashmir is so great that agriculture cannot be carried on at an elevation of much over 7,000 feet, and on the plain itself, at an elevation of from 5,000 to 6,000 feet, early snows sometimes cause disaster by destroying the rice crop. It would need but a slight increase in cold or in snowfall to render the whole country unfit for agriculture and only habitable for nomadic shepherds, who would drive their flocks southward in winter, away from the snow, to the warm, low plain beyond the mountains; and such we may reasonably believe to have been the condition of Kashmir before it appears in history near the opening of the Christian era.

By the sixth or seventh centuries of that era, as history shows, Kashmir had acquired nearly its present prosperous character, and not long after was suffering from the filling of the channel of the Jhelum with detritus from the mountains and the consequent expansion of the lakes. Such prosperity and such disaster would naturally result from a relatively dry or warm epoch such as that which is supposed to have accentuated the general tendency toward aridity during the first six or eight centuries of the Christian era. On the one hand, agriculture would be stimulated, and, on the other, fans of boulders and gravel would be deposited in the river bed, causing the lake to rise, and perhaps to submerge villages.

As to the possible succeeding mediæval interruption of the tendency toward aridity there is little to be said. The deepening of the channel of the Jhelum, and the slight lowering of the level of the Wular Lake are the results to be expected under such circumstances, as are also the famines, which Stein (1899, p. 119), on the authority of Kalhana, describes as taking place in the twelfth century because of prematurely early snowfalls. Similarly the complete freezing over of the Jhelum, described by Kalhana in 1087–8 A. D., and the extreme isolation of Kashmir during the Middle Ages, would be natural if the winters were more severe and the passes more snowy than now.

Altogether, the human history of Kashmir shows a fairly close agreement with the physical history as inferred from the terraces and from their relation to those of other regions. The evidence thus far discovered affords some slight but most interesting indications of the possibility of an acceleration of the process of desiccation during the first part of the Christian era, and of a reversal of the process during the succeeding mediæval ages. Its chief importance, however, lies in the fact that here, in the fairly moist region of Kashmir, in India, south of the main range of the Himalayas, just as in the arid regions far to the west, north, and east, there are somewhat distinct indications that desiccation has actually taken place—that is, that there has been a transition from colder or damper climatic conditions, two thousand or more years ago, to warmer or drier conditions to-day. The transition appears to be part of a widespread change of climate presenting the same general features as the more intense fluvial or glacial epochs of earlier times, and extending at least from Persia and the Caspian Sea on the west to the borders of China proper, three thousand miles away, on the east. In Kashmir, at least, the change seems to have had a notable effect upon the habits and distribution of man, and thus upon his whole development.

COMMANDER PEARY'S ARCTIC EXPEDITION.

The first news of the safe return of Commander Peary and his expedition from the Arctic Ocean north of Greenland was received in a message he sent from Hopedale, Labrador, *via* Twillingate, Newfoundland, Nov. 2. His ship, the *Roosevelt*, had lost two propeller blades, and was otherwise injured. On Nov. 23 the *Roosevelt* arrived at Sydney, C. B., having taken the inside passage through the Strait of Belle Isle and across the Gulf of St. Lawrence. She had stopped at several ports for coal.

The New York *Herald*, on Nov. 21, published a very long cable despatch sent by the explorer from Chateau Bay, Labrador, describing in outline his work in the Arctic and his attainment of latitude of 87° 6′ north, within about 200 statute miles of the pole, which surpasses by thirty-eight statute miles the record of the "highest north" made in 1900 by Captain Cagni of the Duke of the Abruzzi Expedition to the north of Franz Josef Land. Commander Peary's sledge journey to within 200 miles of the pole is the most remarkable on record; and this, with his other experiences and achievements, will give his results a distinctive chapter in the history of Polar Exploration.

Leaving Etah after midnight on Aug. 16, 1905, the *Roosevelt* steamed in open water to Cape Fraser, beyond which she was driven back by ice, but finally reached an open channel close along the Greenland coast, in which she ran to Thank God Harbor. After very severe tussles with the ice the vessel was forced across the mouth of Robeson Channel to Cape Sheridan, which became her winter quarters, about four miles northwest of those of the *Alert* in 1875–76. This position was attained in twenty days from Cape Sabine.

By Oct. 1, one hundred musk oxen and deer had been secured. During that month a considerable number of the dogs died, and it was found they were being killed by cured whale meat that had become poisonous. Peary thus faced the problem of wintering his Eskimos and dogs on the resources of the country. He sent all his dogs and most of the natives in charge of Marvin and Henson south about seventy miles in Grant Land, where they lived in snow houses in the Lake Hazen Basin and along the slope of the United States Range, subsisting upon musk oxen, reindeer, hare and salmon trout.

The winter was remarkable for comparatively high temperatures. There were some furious gales from the south, and at such times water leads were invariably formed along the coast, some of them two or three miles in width. The ice was in motion nearly all the time. The three weeks after Christmas were a period of great anxiety, with the ice-pack surging back and forth and threatening to force the *Roosevelt* up on the ice-foot.

On Feb. 7 all the Eskimos and dogs were brought back to the ship. Of the 220 dogs, 120 remained. A few days later Capt. Bartlett and a party went to Cape Hecla and found leads of water extending north as far as they could see. There were leads along the Greenland and Grant Land coasts, and the northern part of Robeson Channel was open.

The entire party for the sledge journey to the north was assembled at Cape Hecla, consisting of Messrs. Peary, Bartlett, Wolff, Marvin, Henson, Clarke, Ryan, and 21 Eskimos, with 120 dogs. They were to be divided into one main and five or six division parties, which, the explorer hoped, would be able to advance supplies and maintain communication with a base selected for his final point of departure for the pole. Point Moss, 20 miles west of Cape Hecla, was selected as the point of leaving the land. On Feb. 28, Henson led the pioneer party of three light sledges and was followed on the succeeding days by the other parties. Movements of the ice, leads which had to be circumvented, and rough ice where the path had to be cut by pickaxes, made progress slow.

The first glimpse of the sun was on March 6. About 80 miles from the lands ledging greatly improved, but the leads were more frequent and wider. At 84° 38′ N. Peary came up with the advance parties of Bartlett, Henson, and Clarke, who were stalled by a broad lead extending east and west as far as could be seen. There was no immediate prospect of crossing, and so Bartlett and Clarke were sent back with their sledges to bring up more supplies, leaving the Peary and Henson parties to get across as soon as possible. At this time the Marvin, Wolff, and Ryan parties were bound outward from the land on their second trip. The lead slowly widened; but, after six days, when it was two miles wide, the Peary and Henson parties crossed it on the young ice that had formed. Henson pushed on, while Peary remained a day to establish a cache and leave instructions for the other supporting parties.

In three days Peary overtook Henson in 85° 12′ N., camped in a fog. There was a high wind, which increased to a furious gale, with snow, and they were in camp for six days while the storm lasted. When it stopped, Peary's observations showed that he had been driven some 70 miles to the east.

Henson was started northward again, and two Eskimos with empty sledges were sent back to meet any supporting parties that might have crossed the lead before the storm and to bring up the cache at the lead. They returned in three days, saying that they had met open water, which they could not cross.

Peary could no longer count upon supporting parties, and decided that whatever was done must be done by a dash, with the outcome depending upon the weather and the condition of the ice:

> We abandoned everything not absolutely necessary and bent every energy to setting a record pace. Such snow as the wind had not torn from the face of the floes was beaten and banked hard and the snow had been hammered into the areas of rough ice and the shattered edges of the big floes, so that they gave us little trouble. North of Storm Camp we had no occasion for snowshoes or pickaxes.
>
> The first march of ten hours in the lead, with the compass, sometimes on a dog trot, the sledges following in Indian file, placed us thirty miles to the good. Four hours out on the second march I overtook Mr. Henson in his third camp, beside a lead which was closed. When I arrived he hitched up and followed behind my hurry party. I had with me now seven men and six teams, with less than half loads for each.
>
> As we advanced the character of the ice improved, the floes becoming much larger and rafters infrequent, but the cracks and narrow leads increased and were nearly all active. These cracks were uniformly at right angles to our course, and the ice on the northern side was moving more rapidly eastward than that on the southern.
>
> As dogs gave out, unable to keep the pace, they were fed to the others. On April 20 we came into a region of open leads leading nearly north and south, and the ice motion became more pronounced. Hurrying on between these a forced march was made. Then we slept a few hours, and, starting out again soon after midnight, pushed on till noon of the 21st. My observation then gave 87 deg. 6 min.
>
> I thanked God with as good a grace as possible for what I had been able to accomplish, though it was but an empty bauble compared with the splendid jewel for which I was straining my life. But, looking at my remaining dogs and the nearly empty sledges, and bearing in mind the moving ice and the unknown quantity of the big lead between us and the nearest land, I felt that I had cut the margin as narrow as could be reasonably expected.
>
> My flags were put out from the summit of the highest pinnacle near us, and a hundred feet or so beyond that I left a bottle containing a brief record and a piece of the flag which, six years before, I had carried around the northern end of Greenland.

The wind never ceased for an hour on the outward or the return journey. The southward journey was extremely difficult, and the situation of the party was sometimes critical. An ice bridge spanning a lead gave way under them, and they were set adrift on a floe which carried them steadily east for five days, while the lead was widening. The sledges were used as fuel to cook some of the dogs killed for food, as provisions had about given out. They at last succeeded in crossing the lead on the young ice, which bent under every step, and they saw when they reached the pack on the farther side that their fragile bridge had broken behind them.

On May 12 they dragged themselves into the ice-foot of the north coast of Greenland at Cape Neumayer, where, a little later, they found the supporting party headed by Clarke, which had also drifted to Greenland. The castaways were now foodless, but a herd of seven musk oxen was discovered; and Peary killed them all, thus averting any danger of starvation. All the parties were eventually reassembled at the winter quarters. Not a man had been lost, and 41 of the 120 dogs survived the spring campaign.

A week after his return to the ship, Peary started west to complete the outlining of the unvisited coast-line in that part of Grant Land. He very briefly refers to this important feature of his work:

> At Cape Columbia I killed six musk oxen and climbed the summit of the cape, leaving a record and a piece of the Arctic flag in a cairn. From there west to "Aldrich's furthest," then to the land at the northwest angle of Grinnell Land, on the summit of which, 2,000 feet high, I left another cairn and records. Then across a twenty-mile channel to another land, on the northern summit of which, 1,900 feet high, I left a third cairn and record. Twelve deer were secured on this land.
>
> The return journey was a continuation of bad weather, fog, snow and wind. Our marches were greatly hampered by the innumerable lakes and rivers, formed by the melting snow.

Meanwhile, Mr. Marvin had carried a valuable line of soundings along the north coast of Grant Land as far west as Cape Fanshaw, and he and Capt. Bartlett had also completed lines of soundings across Robeson Channel, according to Commander Peary's instructions. The *Roosevelt* had a very severe experience on the southern journey through the Smith Sound channels, and had to be beached at the head of Etah Fiord to caulk the stern, tighten the propeller blades, and prepare the rudder. The Eskimos were landed at various points along the coast which they inhabit. Heavy weather was encountered off Hudson Strait, the rudder was carried away, and another was built and hung with the utmost difficulty. As no coal could be obtained at Hebron, some of the interior beams of the vessel were used as fuel, and small quantities of coal were obtained later at several ports on the way south. The explorer has this to say about his men and his ship:

> Tidal observations, entirely by Mr. Marvin, and meteorological observations, principally by him, were made during the year.
>
> Valuable soundings were made by Messrs. Marvin and Bartlett. Dr. Wolff has looked after the health of the expedition with unremitting care and skill and there has been no serious illness. The Doctor also did his share of the spring sled work. Mr. Marvin, while on board ship during the winter or hunting in the interior and through the spring sledging campaign, assumed his full share of the work.
>
> Captain Bartlett has proved himself invaluable. He has been unsparing of himself in his efforts for the success of the expedition and the safety of the *Roosevelt*. Henson and Percy, my stewards, tried in years of Arctic experience, have again proved their worth. The officers and men have proved interested and willing. Mate Bartlett was in charge of the *Roosevelt* during the absence of Captain Bartlett and myself. Chief Engineer Wardwell, from the time of the failure of our water-tube boilers, two days from Sydney, had a trying and difficult time and has found full scope for his ingenious resources. Two of the firemen—Clarke, of Massachusetts, and Ryan, of Newfoundland—took an active part in the spring sledge work. Boatswain Murphy was of material assistance in the field.
>
> The *Roosevelt* as a sea boat is equal to one of our typical bank fishermen, handy and dry, for which the fullest credit is due to her builder, CaptainDix. In heavy ice she has been very effective, even with her reduced power, forcing her way through apparently impassable places. Young ice, even of very considerable thickness, she treaded under her with great facility,and under pressures she rose readily and easily. Finally,whatever valuation may be placed upon the work and result of the expedition, these results are entirely due to the generosity of the members of the Peary Arctic Club, and especially to the unfailing interest and efforts of its president, Morris K. Jesup.

Mrs. Peary and her little son went to Sydney to await the arrival of her husband.

GEOGRAPHICAL RECORD.

AFRICA.

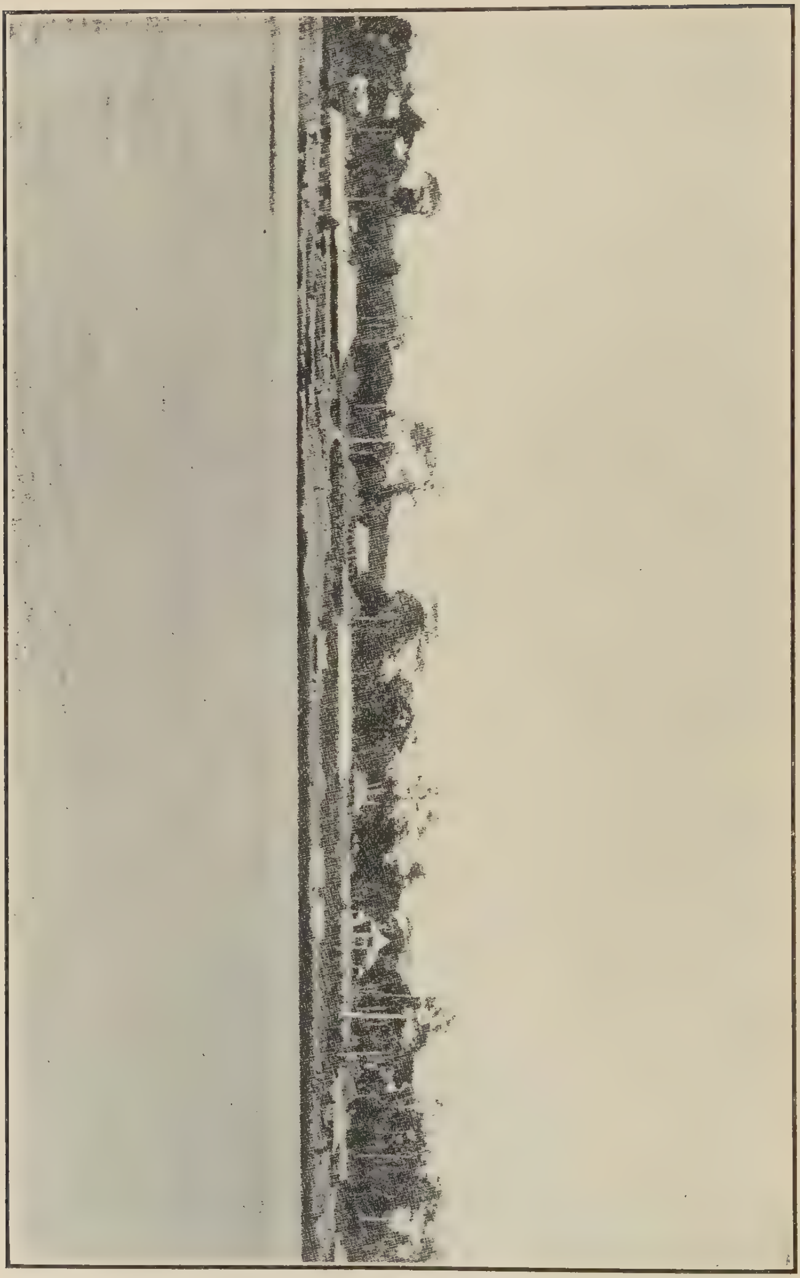
SLEEPING SICKNESS.—The distribution and spread of sleeping sickness in the Congo Free State are treated in the Fourth Progress *Report* of the expedition of the Liverpool School of Tropical Medicine, 1903–1905. The report is written by Dr. John L. Todd, who associates with himself in joint authorship the late Dr. Dutton, head of the expedition, who became a martyr to his devotion to this philanthropic and scientific work. Twenty-three months were spent in the Congo, and some 2,000 miles were traversed by the party. Three maps show the distribution of sleeping sickness in the Congo in 1884 and 1897, and the intensity with which the various districts have been affected by the disease. The expedition found that sleeping sickness follows the main lines of communication, and is often carried into new districts by infected persons.

It is still spreading with terrible rapidity. Cases, probably coming from the west, have already been reported, at Ujiji, on the east coast of Tanganyika; also at the south end of this lake at Moliro, and in the most northerly parts of the Congo Free State at Wadelai and in the Lado enclave. It is recommended, in order to prevent, as far as possible, the spread of the disease, that posts of inspection be established along the main routes leading to uninfected districts in order to prevent infected persons from entering these regions, and that cases of the disease found at posts in uninfected districts be removed to places already infected. It is believed that these measures, if they do not check the advance of sleeping sickness, will at least greatly retard it.

In view of the devastation caused by the sleeping sickness among the natives of the Congo Free State, the King of the Belgians has offered a prize of 200,000 francs to any person who shall discover a cure for the sickness, and also an additional sum of 300,000 francs for the purpose of making researches and experiments toward exterminating the plague.

GEOLOGY AND PETROLOGY OF A PART OF THE CONGO FREE STATE.—Mr. G. F. J. Preumont and Mr. J. Allen Howe have written a paper (*Quarterly Journal* of the Geological Society of London, Aug., 1905) describing what was learned of the geology of the northeast part of the Congo Free State by Mr. Preumont's journey in 1902. The observations were chiefly in the upper Mobangi basin from Tambura and Lado in the north to Wadelai in the south between the Congo and the Nile. They cover only a part of this region, chiefly along the rivers. Granite is the predominating rock. Mr. Preumont demonstrated the absence of fossiliferous deposits in a region where it might reasonably have been expected that they would occur. The abundance of iron in the old crystalline rocks is noteworthy. The investigation extended over 70,000 square miles in a region where a geological survey was rendered difficult and often impossible by the dense vegetation. Mr. Howe contributes a petrological description of the rocks that elucidates Mr. Preumont's observations.

THE NEW CONGO RAILROAD.—The Congo State, on September 1, completed the railroad, 75 miles long, between Stanley Falls and Ponthierville on the upper Congo, thus circumventing the Stanley Falls series of rapids. The railroad around the rapids in the lower Congo between Matadi and Leopoldville, completed in 1898, was built by private enterprise. The new railroad is the first one to be built by the Government. The purpose of the State is to build rail-



STANLEYVILLE.

roads around all the Congo rapids, so that there shall be uninterrupted steam communication between the mouth of the Congo and the head of navigation on the Lualaba head stream of the great river. The entire system of communications will be completed within the next two or three years. Steam communication between the Congo mouth and the end of navigation will then be divided between the land and water routes as follows:

River from Banana to Matadi, 90 miles; railway from Matadi to Leopoldville, 335 miles; river from Leopoldville to Stanleyville, 900 miles; railway from Stanleyville to Ponthierville, 75 miles; river from Ponthierville to Kundu, 195 miles; railway from Kundu to Buli, 276 miles; river from Buli to the head of navigation on the Lualaba, about 300 miles; total length of continuous steam communication on the Congo, 2,471 miles, of which 1,485 miles will be by water and 986 miles by railway. The inland terminus of the route will be in the southeastern province of Katanga, the richest mineral region of the State, and pronounced by experts to be one of the great future sources of the world's copper supply.

LAYING THE RAILS BETWEEN STANLEYVILLE AND PONTHIERVILLE.

The Congo State has issued a pamphlet descriptive of the building of "Le Chemin de fer du Congo Supérieur," between Stanleyville and Ponthierville. It is well illustrated with half-tone photographs and maps. The grading of the new road-bed began in 1903. The route is entirely through dense forest along the left side of the Congo, and through this forest a clearing was made so wide that the railway and telegraph line cannot be damaged by falling trees. Many of the bridges were built of wood; but these will soon be replaced by steel. Steel aqueducts were employed to conduct small streams under the road-bed. Railroad ties and other timber used in constructing the road were sawed in mills at various points along the line. The *bombali* tree is believed to yield the best ties that have yet been placed on railroads in tropical Africa. This is a kind of cedar, close-grained and hard, dark, and a little reddish.

Brick clays were utilized for the production of large quantities of brick used in the construction of buildings along the route. Limestone was brought about 100 miles from near the Aruwimi River, and a large amount of lime was burned in kilns near Stanleyville. Most of the white personnel were Belgians, though the directing force also included Italians, Scandinavians, and Swiss. Most of the machinists, masons, etc., were natives trained in the trade-schools of West Africa, who came voluntarily to the Congo seeking work. They were assisted by many young Congolese who had been trained in the trade-schools, maintained by the Government or the missionary societies. From 80 to 160 white men were employed on the line and about 2,000 blacks.

The black workmen lived in native huts, which they could build in a few hours as they moved forward along the line. They had with them their wives and children; for they are more contented and work better when their family life is not broken. The State provided them with ample supplies of rice and salt, the women using much of the salt to purchase vegetables in the native markets. Two physicians were constantly with the force; two hospitals, for the whites and blacks respectively, were maintained at Stanleyville; every sanitary precaution was taken to preserve the general health, and all the blacks were subjected to vaccination. The death-list among both whites and blacks was very small.

The cost of building the line was from 65,000 to 80,000 francs per kilometer. This included the enormous cost of transporting steel rails from Europe—about 12,000 francs per kilometer. As soon as the railroad reached Ponthierville two steamboats were launched on the narrow navigable stretch of the river, and a large force of workmen was taken up to Kindu to begin the building of the third and last railroad around the Congo cataracts.

CLIMATE IN THE LAKE CHAD REGION.—Recent notes concerning the seasons and winds in the Lake Chad district of Africa, by Audoin, are summarized in the *Meteorologische Zeitschrift,* Vol. 23, October, 1906. From the middle of October to the middle of March northeast winds—the normal trades—prevail, often attaining the velocity of a fresh breeze and producing considerable waves in the lake. After the spring equinox these northeast winds decrease in velocity and regularity, calms and variable winds are frequent; small dry "tornadoes" from the southwest occur, and the temperature rises. In the second half of April the seasonal change is completed; it is hotter; the humidity increases markedly; lightning is seen in south and west; thunder is heard; squalls bring a few drops of rain and the southwest winds set in. These southwest winds are neither as regular nor as strong as those from northeast. There are three seasons. The first, cool, or even cold, from the middle of November to the middle of March, when the northeast trades blow. The temperature maxima are between 79° and 82.5°. In the morning before sunrise the temperature falls 7°-9°, with northeast winds. It is warmer when there is a calm or a southwest wind. The second season is hot. It lasts from the middle of March to the middle of July. The temperature rises considerably, and even the nights are warm. Tornadoes, occasionally with rain, occur over the lake. The third, rainy season, with high water, lasts from mid-July to mid-November. It is then cooler. Tornadoes from different directions bring rains of short duration. The water rises occasionally into mid-December. In 1903 the lake level rose about two feet.

The decreasing depth of the lake is given special attention. This decrease is said to have been going on for decades. The lake has already diminished decidedly in area, and has retreated far from its former shores. The desiccation is general, extending over the whole lake, and not being merely a result of the displacement of the water from east to west, as has been occasionally assumed.

A second paper on the Lake Chad region, by Captain C. H. Foulkes (*Scot. Geogr. Mag.*, Nov., 1906), adds further facts of climatological interest. The climate along the new Anglo-French frontier between the Niger and Lake Chad is comparatively healthy during the dry season, except on the banks of the Niger and on the marshes of the lake, but in the rains it is unhealthy and similar to that on the coast. Europeans became anæmic and enervated, and suffer much from malaria and dysentery. In the dry season the air is filled with fine dust borne by the Harmattan, and objects only a quarter of a mile away are often hard to see. The tornadoes above noted can be seen approaching a mile or two away, their "progress being marked by bushes and trees bent over almost horizontally by the wind, and a long line of churned-up sand." This sand penetrates even "water-tight" tin cases. During the rainy season dry river-beds become rushing streams. After the rainy season the pools of water disappear; rivers dry up, and the only water obtainable is from deep wells in or near the villages. A curious case of seasonal migration into the desert is related of the Tuaregs, who inhabit part of this region. The upper class of these people is nomadic, for the most part, and in the wet season retires into the desert with the camels, which cannot live through the rains. R. DeC. W.

RAINFALL BY CALENDAR AND CROP YEARS AT ALGIERS.—The importance of averaging rainfall data by crop rather than by calendar years when studies of crop production are undertaken is clearly emphasized in a recent study of the rainfall of Algiers from 1868, to 1905, by Ch. Rivière (*Met. Zeitschr.*, Oct., 1906). When the crop year is taken as the basis of the rainfall summary (Sept. 1-Aug. 31) there is a fairly constant relation between the measured precipitation and the harvest. The calendar year 1873 had a normal precipitation of 27.44 inches, which does not in any way explain the actual crop conditions of that year. If, however, the year is begun with September the annual rainfall is 18.92 inches, the lowest in the thirty-seven years of observations. Similarly, in 1881, the calendar year gave 27.90 inches, which does not explain the crop failures and resulting famine of that year. The crop year September, 1880-August 31, 1881, gives the small amount of 19.08 inches, which was insufficient for a good crop. The spring rains from February 15 to May 15 are critical for agriculture in Algeria. After that time a favourable distribution rather than the amount of the rainfall is important. The crop year 1904-05 had a heavy precipitation of 32.39 inches; but the crop was poor, because between March 15 and May 15 the rainfall was deficient. The July and August rains are infrequent and small. In some years these months are rainless. R. DeC. W.

RADIATION PHENOMENA IN SOUTH AFRICA.—Over the bare surface and in the dry air of the Orange River Colony, whose average height above sea-level is over 4,000 feet, local meteorological phenomena which depend upon radiation from sun and from the earth's surface are well marked. At night the descending air drainage from the tops of the kopjes is often clearly visible. At Bloemfontein the military cantonments are on a kopje, and at sunset the smoke from this source makes it possible to trace a complete system of cold air wending its way into the basin in which the city lies. The tops of the kopjes are distinctly warmer than the air over the lower ground, and it is therefore more comfortable to bivouac at the higher levels. Mirages and looming are common, the transition between the warmer air above and the colder air below, in the hollows, being often very marked. Dust-whirls are of frequent occurrence during the warmer hours, varying in size from a few inches in diameter to a hundred feet. They move at the rate of about six miles an hour at a maximum, but the speed of rotation is often fifty to sixty miles an hour. Cumulus clouds are a characteristic feature of summer afternoons. When atmospheric instability becomes very marked, violent afternoon squalls of dust, thunder, lightning, rain, and even hail, occur.—(*Symons's Met. Mag.*, Oct., 1906.) R. DEC. W.

AMERICA.

MAGNETIC WORK IN CANADA.—Dr. L. A. Bauer, assisted by Messrs. P. H. Dike and E. H. Bowen of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, determined during September and October the three magnetic elements (declination, dip, and intensity) at 70 stations in the portion of Canada bounded by the parallels of latitude 42° and 49° and the meridians of longitude 65° and 105° West. In this region very few observations had previously been made. With the completion of this work it is now possible to extend the magnetic maps for the United States up to the forty-ninth parallel across the entire continent. The standard magnetic instruments of the Toronto Magnetic Observatory were likewise compared with those at the Cheltenham Magnetic Observatory, making it possible thereby to reduce all of the magnetic work in the United States and Canada to the same standard. Through the courtesy of Professor Stupart, Director of the Canadian Meteorological Service, the Toronto Magnetic Observatory situated at Agincourt was made available as the base station for the work undertaken by the Carnegie Institution.

THE MAGNETIC SURVEY OF THE PACIFIC.—Dr. Bauer informs the Society that the Magnetic Survey Yacht *Galilee* of the Carnegie Institution of Washington returned to San Diego, Cal., on Oct. 20, having successfully concluded, under the command of Mr. W. J. Peters since March 2d, a cruise of 20,000 miles, embracing San Diego, Fanning Island, Samoan Islands, Fiji Islands, Marshall Islands, Guam, Yokohama, and return to San Diego. Mr. Peters's assistants were Messrs. J. P. Ault and J. C. Pearson, Magnetic Observers, and Dr. H. E. Martyn, Surgeon and Recorder. The sailing master, as in the cruise of 1905, was Captain J. T. Hayes. The two cruises of 1905 and 1906 of this vessel have already furnished sufficient data for the revision of the present magnetic charts of the North Pacific Ocean.

It was expected to despatch the vessel soon on a cruise to Valparaiso, Rio de Janeiro, Washington, D. C., and thence to the Pacific Ocean by way of the Cape of Good Hope and the Philippines in order to obtain some results as soon as possible in the other oceans. It was finally decided, however, that it would not be advisable to undertake the circumnavigation cruise in the present vessel. The work will, therefore, be confined at present to the practical completion of the magnetic survey of the North Pacific, as far as that can be done in a sailing vessel. The *Galilee* will start out in December from San Diego and proceed to the Marquesas Islands, and thence to Tahiti, Apia, Yap, Shanghai, Hongkong, Yokohama, Honolulu, Dutch Harbor, Sitka, and back to San Diego.

The remaining work in the North Pacific is in regions near islands and coasts where a vessel with auxiliary power will be needed. The Survey now urgently needs a specially-constructed non-magnetic, auxiliary-powered wooden sailing vessel to carry on the oceanic magnetic surveys in conformity with all the scientific requirements involved and with due regard to the safety and comfort of the observing party. Preliminary plans and specifications for such a vessel have been drawn up, and it is found that she will cost about $75,000. The Survey should be equipped with the most approved appliances known to science. Instruments and methods have reached the highest stage of perfection, but it now remains to supply a vessel which will not necessitate the determination of deviation corrections. "Swinging ship" at sea is more or less troublesome, especially under sail. The cruises of the *Galilee* have proved that observations on the course may be taken with all necessary scientific accuracy, provided the observers are certain of the deviation corrections on the particular course traversed. These corrections depend, not alone upon certain mathematical laws, but also upon accidental factors which cannot be adequately considered in mathematical formulæ.

CHANGES ALONG NEW JERSEY COAST.—Under the above title, Mr. Lewis M. Haupt has prepared a most interesting paper, published in the Annual Report of the State Geologist of New Jersey for 1905. He points out that this coast is one of the most dangerous in the United States, and one in which there is no harbour of refuge, in spite of the urgent demand for one, which has frequently been pressed. Between Sandy Hook and Delaware breakwater, a distance of 134 miles, there are believed to be more disasters to ships than on any other stretch of coast-line of equal length in the country. Within the twenty-three-mile range of the lighthouse at Atlantic City 170 casualties were reported in ten years, as compared with 83 within range of the light at Fire Island, and 25 in the dreaded Cape Hatteras region.

The New Jersey coast has importance, also, from an entirely different standpoint. It has come to be one of the most important coast resorts in the country. In fact, in some sections the value of property has increased many thousandfold as a result of this development. In Atlantic City, for example, in twenty-six years the resident population has increased from 6,000 to nearly 40,000, while the transient population exceeds 200,000.

Both the industry of shipping and the entertainment of summer guests are influenced by the marked changes in progress along this coast. These changes are of several kinds. In the first place, inlets are rapidly closing, and harbours which were accessible to coasters within the memory of men now living near them are being closed by a drift of sediment. In the second place, there are numerous instances of the cutting away of beaches and the destruction of valuable property by the attack of the waves. In the third place, the bar-like beaches are being extended by the drift of sediment along the coast before the prevailing waves, and eaten away on the ends exposed to these waves.

For example, the spit which forms the northern boundary of the entrance to Little Egg Harbor has moved southward at the average annual rate of 168 feet between 1769 and 1885, and since 1885 at the rate of about 200 feet a year. Changes at this point are illustrated by the resort known as Sea Haven, which is now laid out across what was formerly a navigable channel. While the spits are being built southward across inlets, the opposite sides of the inlets are being worn away by the wave attack and tide scour. At Hereford Inlet, a few years ago, the Hotel Royal stood on what is now an extensive mud flat, covering an area of one square mile, and exposed only at low water. This hotel has been moved back three times to escape destruction from the rapid encroachment of the inlet.

Haupt gives many instances similar to this along the New Jersey coast, some of them illustrated by photographs and maps, on which successive changes are marked. It is an important article to the student of geography, and deals with a subject of great interest to the nation. One of the chief points of his paper is to consider the question of what is to be done to stop these changes, and in this discussion he points out the fact that many of the efforts that have been made are of little avail. Is it impossible to abstract his discussion of this subject, but his general conclusion is "that there is urgent need for remedial legislation looking to the opening of the harbours, the reclamation of the beaches and extension of the seaside resorts, the increase in the accessibility of all parts of the shore and its adjacent waters, the establishment of permanent land-marks along the coast, the encouraging and restoration of the fishing, ship-building, and manufacturing interests along the seaboard, and the utilization of the tidal power and reclamation of the tide flats as a source of wealth." R. S. T.

THE DEVELOPMENT OF SANDY HOOK.—In the same article Mr. Haupt notes the changes in the Sandy Hook region. This hook is a region of deposit of sediment supplied by wave attack upon the highlands to the south and drifted northward before the waves and tidal currents. According to the maps of the Ratzer surveys of 1769, the Navesink Highlands, which attain an elevation of 240 feet above sea-level, were at that time open to the full force of the Atlantic waves. The fact that salt marshes are absent north of Navesink River, which then apparently entered the ocean directly, is further indication of the recency of the deposit which now protects these bluffs from the ocean waves. It is believed, therefore, that since 1769 the drift of sediment from the bluffs to the southward has gradually overlapped the face of the Navesink Highland cliffs, closing the mouths of the Shrewsbury and Navesink Rivers, as is at present the case. The present supply for the continued growth of Sandy Hook is now derived from the bluffs between Monmouth and Bay Head, and here the coast-line is rapidly receding.

It is a well-known fact that the persistent and continued growth of Sandy Hook, particularly of its submerged portion, is a constant menace to ships entering New York Harbor; and large sums of money have been expended by the United States Government in deepening and maintaining this channel. Since the cause for this condition is the supply of shore drift derived by wave attack from the cliffs to the south, it is evident "that the arrest of this shore drift would manifestly aid in the securing and maintenance of deeper channels at that important highway of commerce." R. S. T.

RAINFALL IN THE GREAT LAKE REGION.—Professor M. S. W. Jefferson, of the State Normal School, Ypsilanti, Mich., has constructed a map of the rainfall in the region about the Great Lakes, in preparing which the rainfall data for shorter periods are reduced to long series, in the way which has long been recognized abroad as essential if accuracy is desired, but which, thus far, has received practically no attention whatever in the United States. The period for reduction is 1880-1904; 143 stations were used. Of these stations, 48 have records for from five to nine years only. A rainfall chart, in constructing which the data were employed without regard to the length of the period of observation, is given for purpose of comparison, and it is somewhat surprising to see that the changes resulting from the reductions to a uniform period are comparatively very slight. Some study of the relation of the Lake rainfall to topography is made, and there is a general, though brief, discussion of the distribution of rainfall. For purposes of comparison, a chart is given in which incomplete rainfall records are reduced with reference to the means of six groups of selected stations; another, published by the Weather Bureau in 1902, in which some reduction of short series to long series was attempted, and another, prepared by C. A. Schneider, originally published in 1900. The author is quite right when he claims that his new rainfall chart is an advance on its predecessors.

R. DeC. W.

CLIMATE OF CANADA.—At the recent York meeting of the British Association, Professor L. W. Lyde read a paper on the "Climate of the Wheat Area of Central Canada," showing how the climatic conditions favour the growth of the crop, especially along a line through Brandon and Battleford. A high estimate of the probable output of wheat from this area in the immediate future was given, but the opinion is expressed that wheat-growing here is eminently the work of the small farmer. So far as wheat cultivation is concerned, spring is limited to the four weeks in April. With a unit of population (one family of five persons, at least two being males) the maximum of plough, harrow, and drill that can be "risked" is 80 acres in the four weeks. In summer, which is the rainy season, the duration of sunlight varies from about 15½ hours a day at midsummer in the Winnipeg district to over 17 hours at Prince Albert. The length and intensity of the cold winter do not affect the northern limit of wheat in summer.

R. DeC. W.

GEOGRAPHIC INFLUENCE IN AMERICAN TRADE.—Commercial America in 1905, a publication of the Bureau of Statistics of the Department of Commerce and Labor, while purposing to show the Commerce, Production, Transportation, Finance, Area and Population" of the American countries, makes apparent some of the reasons for the present deplored conditions of our trade with the other American states.

Proximity and physical freedom of intercourse are shown to be two strong factors, as follows: Imports of all North America other than the United States are $531,000,000, of which 54.7 per cent. came from the United States; imports of all South America are $474,000,000, of which only 13.5 per cent. came from the United States. Exports of all North America except United States are $537,000,000, of which 53.9 per cent. goes to the United States; exports of all South America are $702,000,000, and only 20.2 per cent. goes to the United States.

When proximity is made to include physical freedom for intercourse these figures show an interesting agreement between distance from the United States and the relative value of commerce with the United States. As we analyze still more closely, the commerce of seven selected countries in 1904 sets forth a similar ratio between trade and distance. Imports from the United States amounted to: 59 per cent. of Canada's imports; 56 per cent. of Mexico's; 43 per cent. of Central America's; 34 per cent. of Colombia's; 11 per cent. of Brazil's; 13 per cent. of Argentina's; 12 per cent. of Chile's. The relative approachableness of Brazil to New York and Liverpool is also suggested in the fifth item.

Other geographic reasons for our relatively small trade with South America are found in the following facts:

(1) The population of South America is sparse, the total, according to Supan (1904), being 38,482,000.

(2) It is at present still essentially an agricultural country, while our heaviest exports are agricultural (over 55 per cent. of all our exports in 1905 were of this class).

(3) Owing to climatic differences existing between the various South American countries, about 30 per cent. of their imports come from their near neighbours.

(4) The people of European countries, whose dense population makes them more essentially manufacturing than we, succeed in placing their manufactures in South American markets, to our exclusion.

(5) Products of Europe, South America, and the United States, by virtue of climatic and industrial conditions, are such that three-cornered trade is common—*i. e.,* vessels from South America to the United States load with rubber, coffee, hides, and wool, which they exchange with us for grain and provisions, and then sail to Europe, where they exchange our products for manufactures, and return to South America. This is further encouraged by the fact that we send more to Europe than we buy from her.

(6) A study of the map of the Atlantic, especially on a globe, will reveal the fact that some of the South American ports are nearer to European centres than they are to our own, and that most of them are at least as convenient to European countries as to us.

Another handicap to our South American trade, though not geographic in itself, has in part grown out of geographic conditions. Most of the vessels carrying goods to South American ports are controlled by European capital.

The above-mentioned report further mentions the lack of banking and business facilities between the United States and South American states, and the neglect of our merchants and manufacturers to study and heed trade methods and requirements of the South American market.

One conclusion reached is that improvements which shorten the distance between us and our South American neighbours make for increased commerce. Thus the author sees improved trade with the opening of the Isthmian Canal and the completion of the Trans-Andean railroad from Argentina to Chile. With these and a larger number of American vessels to both Atlantic and Pacific ports we may expect a more gratifying commercial intercourse.

The report is completed with many tables of statistics analysing the industries and trade of each country. G. D. H.

ASIA.

THE PILGRIM RAILROAD TO MECCA.—The building of the Pilgrim Railroad which is to connect Damascus with Medina and Mecca, the holy cities of Islam, has not attracted much attention in the Occident. Auler Pasha, a German military officer, now a general in the Turkish army, who has had the best opportunities for studying this great project, has filled this important gap in our knowledge of great railroad enterprises by writing an exhaustive paper, with a good map, which appears as *Ergänzungsheft* No. 154 of *Petermanns Mitteilungen.*

The *Irade* of the Sultan of Turkey calling upon Mohammedans in every land to supply the means for building the road was issued in July, 1900. The contributions have been large and continuous and are supplying nearly all the funds. There is no longer any doubt that the project will be completely carried out. The entire length of the line between Damascus and Mecca will be 1,800 kilometers. In 1904, the section Damascus-Mahân (459 km.) was completed. Last year the line was extended to Mudewwere, 572 km. from Damascus. By the end of this year it will be opened to Tebuk, 670 km. In other words, by the end of this year over one-third of the line between Damascus and Mecca will be in operation.

Every Moslem who can afford the expense expects to make the pilgrimage to Mecca at least once in his life. Most of the pilgrims, averaging about 100,000 a year, reach the Holy City by the sea route to Jiddah and the caravan road from that Red Sea port to Mecca. Only about 10,000 pilgrims, chiefly Syrians, take the long and difficult desert route from Damascus. It is to enable numerous pilgrims from European Turkey, Asia Minor, Persia, and north Africa to make the journey more expeditiously, comfortably, and cheaply that the Pilgrim Railroad was projected. It is intended that the pilgrimage shall be placed within the reach even of many poor Mohammedans.

But, in addition to the religious purpose to be served, the railroad will undoubtedly be of great strategical importance at the Turkish Government. The nomads of the Arabian desert will be within reach of Turkey's military arm, and pilgrims will be safeguarded against their attacks. During the rebellion in Yemen in 1905 the Sultan sent battalions of infantry southward over the completed part of the road to within four days' march of the Gulf of Akaba, Red Sea, where steamers awaited them, and the troops reached Yemen, it is said, in eight days' less time than would have been required by way of the Suez Canal.

At the end of 1905, 46,700,000 francs had been expended in construction works, most of the money being the offerings of the Faithful, a small part, however, being raised by the stamp tax and the revenue from the sulphur and phosphate mining works along the railroad.

All of the technical staff are foreigners, the chief engineer, Meissner Pasha, being German. Austrians and Italians, as well as Germans, are prominent in the more responsible positions. Most of the railroad material, such as rails, ties, and rolling stock, is imported. All the artisans and common labourers are Turkish soldiers detailed for the work, and 5,700 of them are now engaged in it. They receive a small advance on their regular pay, and their religious zeal helps them to endure with fortitude the unusual discomforts of hard labour in a desert glowing with heat.

The line has been built southward from Damascus parallel with the Jordan Valley and 50 to 60 kilometers from it, following chiefly the old pilgrim road through the basin of Hauran and the east Jordan lands to the Arabian desert, through which it is now being extended towards Medina. The cost of transporting all the railroad material over the French railroad from Beirut to Damascus and southward steadily increased as the road progressed. It was, therefore, decided to build a branch from the port of Haifa to the Pilgrim Railroad, at Dera. This branch, 161 kilometers long, was opened to business on Sept. 1, 1903. Being a part of the Pilgrim Road, the branch not only cheapens the transportation of building material, but is expected, also, to serve in future as a short cut by which many thousands of pilgrims from the Mediterranean will reach the main railroad.

The main line is being extended almost entirely over a waterless and desert highland, where no vegetation grows and very few people live. For hundreds of miles there is not a single permanent human settlement within 50 to 100 kilometers of the track. There are a few small oases in the waste, but the entire country from Damascus to Medina is occupied only by small bands of Bedouin nomads and their flocks. Between Damascus and Mudewwere 1,532 bridges, aqueducts, cuttings, and other artificial works have been required. The greatest difficulty is the scarcity of water. It is derived from a few scattering cisterns and wells; and to the south the embarrassment is intensified. Efforts are being made to relieve the situation by sinking new wells, some of them artesian. All the water now used for drinking and cooking purposes and for preparing mortar is carried to the railhead in water-cars. This adds much to the cost of the enterprise.

The country supplies no wood, coal, or petroleum, but all fuel must be imported. Fortunately, the climate is so warm that little fuel will be required excepting for the locomotives and machine shops. Plenty of stone is found *in situ* for constructing the station buildings, bridges, etc. The rolling stock, imported from Germany and Belgium, includes at present 43 locomotives, 522 freight, and 31 passenger cars and 15 water-cars. Three round trips are made each week between Damascus and Mudewwere, and during the height of the pilgrim season five passenger trains leave Damascus daily for the railhead, where caravans of camels are kept in readiness to carry the pilgrims on their way. The average speed of passenger trains as yet is only twenty-three kilometers an hour. It is expected that the present rate of construction will be maintained until the road is completed. If this hope is realized trains will be running to Mecca in 1915.

The French Lebanon Company has completed its railroad from Damascus northward to Hama, and will soon be able to run trains still farther north to Aleppo. It is expected that before the Pilgrim Railroad is completed the German line through Asia Minor will be finished to Bagdad and the Persian Gulf. The French line need be extended only a short distance northward from Aleppo to join the German line. Mecca will then have 3,700 kilometers of continuous rail connections, extending from Constantinople (Skutari) across Asia Minor to the Persian Gulf. The Pilgrim Railroad will be thronged with devotees from European Turkey, Asia Minor, and Persia, who will make the journey to the holy cities practically all the way by rail.

CHANGES OF CLIMATE IN ASIA MINOR.—Evidence of changes of climate within historic times has often been based on the fact that where now we find small populations and abandoned wells or irrigation works, there were formerly more inhabitants, extended irrigation, and abundant vegetation. These supposed changes of climate are, however, often easy to explain on the ground of a change in the habits of the people, in their government, or in their numbers. In his address on *Past and Present in Asia Minor,* delivered before the York meeting of the British Association, Professor Ramsay brought out this very point. The conquest of Asia Minor by the Turks meant the reduction of a great part of the country from a settled and civilized state to a semi-nomadic condition. The industries of the Roman Empire gradually died out in large measure, some surviving until now and some having disappeared within the memory of living men. The land to a great extent passed out of cultivation; irrigation works were destroyed or fell to pieces; the land became stony; terraces were destroyed. The only cure is to be sought in generations of peasant proprietors. The olive almost ceased to be cultivated, not, it should be noted, because of change of climate, but because of change in the habits of the people. Recently there has come a revival of prosperity. Communication by roads and railways is being restored. Industries are reviving; an industrial population is spreading along the railways. Agriculture is being developed; cotton is being grown; the waste land around Smyrna is being reclaimed because *bona-fide* cultivators are securing allotments of land. The whole picture furnishes an excellent illustration of how man, if he be so disposed, can largely master climatic handicaps. A change in man, not of climate, has been taking place in Asia Minor. R. DeC. W.

EUROPE.

The Trough of the Rhine where it enters Lake Constance.—In Col. J. J. Lochmann's paper "De la Cartographie en Suisse" (*Le Globe,* Geneva, Tome 45, 1906) he gives some details concerning the trough, revealed by soundings, which the Rhine has made at its entrance into the lake. This deep and narrow trench is bordered by embankments, composed of sand and alluvial material. M. Forel advanced the following explanation:

The water which the Rhine pours into Lake Constance is much colder than that of the lake, and therefore sinks to the bottom and continues its course with a part of the velocity it had attained. Thus it deepens its channel on the lake floor; furthermore, being heavily charged with alluvium, it deposits this material to the right and left of its course. It has thus both excavated the lake floor and raised embankments on either side above the general level of the lake bottom. The trough and accompanying embankment do not follow a straight line, but form capricious meanders as far as Arbon, about six miles from the Rhine's entrance into the lake. There the trough widens, but is less deep, and finally disappears.

Other affluents of the lake do not produce the same effects, probably because their waters are not so cold and are inferior in volume and do not carry so much alluvium.

This discovery, made in 1885, raised the question whether similar phenomena would be found in Lake Geneva where it receives the Rhône. Investigation shows that the same condition of things exists on the floor of that lake. The sub-lacustrine ravine is, however, a little longer than in Lake Constance, and has a straighter course. None of the other affluents of Lake Geneva shows the same phenomena.

Forests and Rainfall.—The ever-recurring problem concerning the influence of forests upon the amount of rainfall is gradually being solved in the only possible satisfactory way—namely, by careful studies of the influence of different exposures of the rain-gauge, of wind, and of snowfall upon the resulting catch. Dr. J. Schubert, of the Meteorological Division of the Forest Experiment Station of Prussia, is giving this matter careful attention, and his conclusions are certain to be of very great service in throwing light on this very obscure question. Hitherto, hasty generalizations, based on incomplete and inaccurate data, have been widely quoted and have found general acceptance. The observations recently carried out were made in western Prussia and Posen. They showed at first a probable excess of 2.3% at a station in an opening within the forest in western Prussia, and of 0.8% at a similar station in Posen as compared with stations outside the forest, the distance from the forest being 1 km. in both cases. The general result is similar to that previously obtained in Silesia, in showing a larger measured rainfall at forest stations than in the open, the excess *averaging* at a maximum between 1 and 2%, the distance of the forest being 1 km. in all cases. This value, however, is an outside limit of the forest influence, for no account is here taken of the effect of wind on the rainfall catch. Careful observations show that the effect of wind in a forest opening is an important factor in giving somewhat larger precipitation there than in the open. All rainfall data from forest stations which are not corrected for wind effects are misleading, in that they exaggerate the forest influence. It is also clear that the amount of snowfall caught in the gauge is much affected by wind, and that the error of an unprotected gauge increases with the number of days with snow. Hence a forest gauge will show more precipitation the more snowfall there is. Dr. Schubert comes to the conclusion that, when the influence of the wind is taken into account, his forest station does not show more precipitation than the open. R. DeC. W.

THE NINTH INTERNATIONAL GEOGRAPHICAL CONGRESS: CIRCULAR OF INVITATION, PRELIMINARY INFORMATION AND PROGRAMME.—The Congress will be held at Geneva from the 27th of July to the 6th of August, 1908. Membership may be acquired by payment of 25 francs (=20 marks=1 pound sterling=five dollars) to M. Paul Bonna, Treasurer of the Committee on Organization, 3 Boulevard du Théâtre, Geneva. An additional payment of 12.50 francs will secure a card of admittance for a lady or a person under twenty years of age. These will enjoy all the privileges of members except the rights of voting and of receiving the publications. Payment must, in every case, be made in advance.

The sessions of the Congress will be of two kinds: the General Sessions, of which there will be at least eight, and the Sessions of the Sections.

The Sections will be constituted as follows (subject to modification by the Committee on Organization):

Mathematical Geography and Cartography;
Physical Geography in General;
Vulcanology and Seismology;
Glaciers;
Hydrography (Potamography and Limnology):
Oceanography;
Meteorology and Climatology;—Terrestrial Magnetism;
Biological Geography (Botanical Geography and Zoogeography);
Anthropology and Ethnography;
Explorations;
Economical and Social Geography;
Teaching of Geography;
Historical Geography.

Every communication or paper intended for the Congress must be accompanied by a résumé clearly written, or typewritten, on one side of the leaf, and not more than 300 words in length, to be sent in as soon as possible and at the very latest by November 30, 1907, to the Committee on Organization. By this Committee the résumé will be referred to the proper scientific Commission for examination and the Executive Commission will report to the author, without delay, the decision made. The national tongues of Switzerland—German, French and Italian—and the English language are the recognized languages of the Congress. Communications, oral or written, may be made in any one of these four languages, and memoirs may be submitted also in Latin. The length of communications, whether read or spoken, is limited to fifteen minutes or, by special exception, to twenty minutes. This limitation applies also to discussions. The members of the Congress will understand the necessity of complying with this arrangement and the presiding officers will see that it is strictly observed, since upon this will depend the carrying out of the programme, the orderly conduct and the success of the Congress.

This regulation relates only to the sessions of the Sections. In fixing the order of the day for the General Sessions the Executive Commission will determine the time to be allotted to each object.

The Committee on Organization will establish, in 1907, the definitive rules and programme of the Congress and of the Sections, so that they may be brought to the knowledge of all who are interested by the month of January, 1908.

This Committee will be charged with the management of the Congress when assembled and with the carrying out of the programme.

After the Congress, the Committee on Organization will publish the Compte Rendu (reports, memoirs, resolutions, &c.), if it can be done in 1909, and in any case before the close of the year 1910. The Compte Rendu will be sent *free* to each member of the Congress.

The Honorary Presidents of the Congress are:

The President of the Swiss Confederation;

The President of the Council of State of the Republic and Canton of Geneva;

H. M. Leopold II., King of the Belgians, Sovereign of the Congo Free State;

H. M. Charles I., King of Rumania.

The President is M. Arthur de Claparède, the President of the Geographical Society of Geneva.

The long list of the Honorary Vice-Presidents is headed by the four surviving presidents of the preceding International Congresses:

The Duke di Sermoneta, Prince of Teano (Congress of Venice, 1881);

Dr. Albert Gobat, Councillor of State and National Councillor (Congress of Berne, 1891);

Sir Clements R. Markham (Congress of London, 1895);

Commander Robert E. Peary, U. S. N. (Congress of 1904, in the United States).

PERIODICITY IN THE TEMPERATURE OF STOCKHOLM.—Woeikof has investigated the temperatures at Stockholm for the 150 years 1757 to 1906, inclusive (*Met. Zeitschr,* Oct., 1906), without prejudice in favour of any definite periodicity, such as that of the sunspots, or the Brückner 35-year cycle. It appears that Stockholm has a very warm winter in every eighth year, January being the most concerned in this departure and February the least, of the winter months. As, especially in winter, similar departures from the mean extend over large areas, this phenomenon is probably to be found over much of Europe. Woeikof has already shown that it holds in St. Petersburg. Woeikof is not inclined to look for any cosmic influence in this eight-year period, but seeks the cause in a shift in the location of the areas of high and low pressure, which results in giving cold winters in the south, and especially in the southeast, of Europe when the winters are warm in the north. R. DEC. W.

MARSEILLES GEOGRAPHICAL SOCIETY.—The Geographical Society of Marseilles is thirty years of age this year. The first number of the thirtieth volume of its *Bulletin* celebrates the occasion by publishing the history of the Society, a list of its members, and an excellent index to the volumes of the *Bulletin,* which will be welcomed in geographical circles generally as a useful bibliography. Among the illustrations are pictures of some of the past and present officers of the Society, and views of the Committee-room and library.

POLAR.

CAPTAIN AMUNDSEN RETURNS TO EUROPE.—Captain Roald Amundsen, his first officer, Lieut. Hansen, and the crew of the *Gjöa* arrived in New York on Nov. 6, having left their vessel at San Francisco. A short stop was made in Chicago, where, on the evening of Nov. 3, the Geographical Society of Chicago gave a banquet at the Union League Club in honour of Captain Amundsen's three and a half years of successful exploration in the region of the magnetic north pole, and the making of the Northwest Passage. Addresses were made by Captain Amundsen, Lieut. Hansen, Professor Henry J. Cox, President of the Geographical Society of Chicago; the Norwegian Consul, Frederick H. Gade, and by Professors R. D. Salisbury and T. C. Chamberlin of the University of Chicago.

On the evening of Nov. 7 the party were entertained at the rooms of the Germania Club, Brooklyn, at a dinner given in their honour by the members of the Norwegian Club of New York. Mr. Anton A. Raven, Recording Secretary of the American Geographical Society, represented the Society at the dinner. A letter was read from President Roosevelt congratulating Capain Amundsen on his Arctic work. Capt. Amundsen made a brief speech on the work of the expedition. Nov. 8, he sailed for Norway.

CANADIANS WINTERING IN THE ARCTIC.—The Canadian Government steamer *Arctic* sailed from Quebec last summer for northern latitudes *via* Greenland. She will winter in Lancaster Sound.

VARIOUS.

FURTHER EXPLORATIONS IN THE UPPER AIR.—*Science* says that the third cruise of the *Otaria,* the steamer yacht sent by M. Teisserenc de Bort, director of the private meteorological observatory at Trappes. near Paris, and by Mr. Rotch, director of the similar observatory at Blue Hill, near Boston, to explore the atmosphere over the tropical Atlantic, has ended, and the yacht has returned to Havre after a very successful voyage of three months and a half.

Atmospheric soundings with balloons and kites were executed over the central part of the North Atlantic, the equatorial regions, and the South Atlantic as far as Ascension Island. The soundings southwest and northwest of the Canaries confirm the conclusions reached during the two preceding cruises of the *Otaria* —namely, that the upper anti-trade blows from the southeast or southwest, not only within the tropics, but generally as far north as latitude 30°, and is found above the open ocean as well as above the Canaries. Farther north it is transformed into a westerly wind.

The observations with *ballons-sondes* revealed this new and important fact, that in summer over the equator very low temperatures (reaching — 80° C.) exist in the upper air above 12 kilometers, being analogous to those occurring in winter at the same height in our own latitude.

TROPICAL RAINS.—After a close study of tropical rains, extending over many years, and especially of the rainfall of Java, Woeikof comes to the conclusions here enumerated (*Met. Zeitschr.,* October, 1906):

1. The intensity of tropical rains is, on the average, greater than the intensity in middle latitudes.

2. The difference is not very great.

3. The heaviest sudden downpours have thus far been observed in middle latitudes.

4. General, light rains of considerable duration are known in many parts of the tropics, and even have special names. Such rains have long been known for the west coasts of South America and Africa, but in the foregoing statement other tropical districts are referred to.

5. The heaviest daily rainfalls have been observed outside the tropics, thus in Cherrapunji, Assam, 40.94 inches; Tanabe, in Japan, 35.51 inches, and at two other stations in northern India over 30 inches.

6. It is probable that the heaviest rains in the tropics fall during large cyclones.

7. A larger number of self-recording rain-gauges, and detailed discussion of the results, especially in cases of the heaviest rains, are very much to be desired.

8. It would be especially interesting to know whether in the tropics, as in the higher latitudes, the larger rainfall amounts on the windward sides of mountains do not depend on the longer duration of the rain, rather than on their greater intensity. R. DeC. W.

ISLANDERS OF TRISTAN DA CUNHA.—A Blue-Book, issued by the British Colonial Office, says that in view of the poverty of the islanders of Tristan da Cunha, correspondence was opened with the Ministry of Cape Colony concerning the deportation of the islanders to that colony. The Cape Ministry replied that it was prepared to share the cost and would send a representative to the island to lay the proposal before the inhabitants. Mr. Hammond Tooke was accordingly sent there; but as the majority of the islanders decided to remain, the Cape Government took no further steps. Most of the Blue-Book consists of an exhaustive report by Mr. Tooke on the islanders, including recommendations for the ameliorization of their condition. He proposed that a chaplain and schoolmaster should be appointed at an early date. The islanders numbered 15 males, 24 females, and 43 children. They are unable to contribute £75 for the salary of a schoolmaster, as was suggested by the Cape Government. In April last a clergyman and his wife went to the island for the purpose of ministering to the needs of the inhabitants.

NEW MAPS.

AFRICA.

EAST AFRICA PROTECTORATE.—Map to illustrate the "Masai, their Language, and Folklore." Scale, 42 miles to an inch. The Oxford Geographical Institution, 1905.

The map illustrates a book by Mr. A. C. Hollis with the above title. It shows the distribution of this tribe before they were collected on reservations. Masai names are written in red, and the territory occupied by the tribe, both in British and German East Africa, is tinted brown.

AFRICA.—Raised Map of Africa—(1) Physical Features, (2) Political Divisions with Guide. Weekly Summary, Eltham, Kent, England, 1906. (Price, 1s. 9d.)

The map is intended for the blind. Two sheets are modelled, one giving the principal physical features of the continent, and the other the chief political divisions. On the physical sheet is an indication of the points of the compass. The scale of the map is 100 miles to three-sixteenths of an inch. Meridians of longitude are indicated at the top and bottom by straight strokes. Parallels of latitude are indicated by threads carried across the map, the Equator being shown by a thicker thread. The sheets are accompanied by text in Braille giving a large number of facts relating to the continent, some of which are not as accurate as might be wished. Lake Lanji, for example, is mentioned as one of the lakes through which the upper Congo flows; but it was proved, years ago, that this lake does not exist. On the political map all the physical features are omitted, excepting the Nile River and the larger lakes. The boundaries of the various states and colonies are shown by raised lines, and the principal towns are indicated by dots.

AMERICA.

U. S. HYDROGRAPHIC OFFICE CHARTS.

Pilot Chart of the North Atlantic Ocean, November, 1906.

NORTH AMERICA.—Carte Géologique de l'Amérique du Nord. Scale, 15,000,000, or 78.9 statute miles to an inch. By Henry Gannett, Geographer, and Bailey Willis, Geologist. U. S. Geological Survey, Washington, D. C., 1906.

This large geological map of North America, including Greenland, was the joint work of the geological surveys of Canada, the United States, and Mexico. A copy of the map was presented to each member of the Tenth International Geological Congress at Mexico City in September last. Twenty-five tints are used to show geological formations, and the meaning of the colours is explained in French and Spanish letterpress. An explanation of the map, written by Mrs. F. B. Adams, was distributed among the members. The map is to undergo further revision, and will eventually appear, it is said, as one of the *Professional Papers* of the U. S. Geological Survey. The colours are printed with delicacy, the registration is perfect, the present geological knowledge of the continent is perhaps set forth as fully as can be done on a map of this scale, and the product is certain to be very useful.

CANADA.—Map of the Dominion of Canada showing Progress of Field Operations by the Geological Survey, 1843-1903. Scale, 250 statute miles to an inch. *Annual Report* Geological Survey of Canada, Vol. 25, 1902-3, Ottawa, 1906.

This small-scale map illustrates a summary report by Dr. Robert Bell. It gives an idea of the vast amount of good topographical work performed by the Survey during the past sixty years. Most of the occupied area in the south has been geologically surveyed and partly mapped. These regions are coloured dark red, while areas in the settled districts that have been less completely investigated are light red. The routes explored and surveyed in the more northern parts of Canada are also shown in red. These reconnaissance surveys extend through all parts of the country to a distance of about 1,000 miles northward from the international boundary.

CANADA.—Map of Part of Northwestern Ontario, North of Lake Superior. Scale, 16 statute miles to an inch. *Annual Report* as above.

One of the canoe routes from Lake Superior to the Albany River flowing into James Bay crosses the Height of Land north of Montizambert on the Canadian

Pacific and follows the Nagagami River to its junction with the Kenogami, and thence to the Albany. Mr. W. J. Wilson made an instrumental survey of this route between Lake Superior and Hudson Bay, and the results are shown on this map.

CANADA.—Map of Part of Northern Ontario and Eastern Keewatin, Southwest of James Bay. Scale, 16 statute miles to an inch. *Annual Report* as above.

Illustrates a summary report by Mr. W. J. Wilson, on his exploration and survey of the regions between the Attawapiskat and Albany Rivers and between the Albany and Moose Rivers, on the west coast of James Bay. These and similar surveys are enlarging our knowledge of the water systems tributary to Hudson Bay.

CANADA.—Sketch Map of Part of Southwestern Ontario showing Shorelines of Ancient Great Lakes. Scale, 24 statute miles to an inch. *Annual Report* as above.

In that region evidences of ancient water-levels above the shores of the present lakes are shown by shore-lines cut into the clays or gravels by terraces formed of stratified deposits and by beaches thrown up by the waves. This is a map of these ancient shore-lines to the north of Lake Ontario and Erie, illustrating a report by Dr. Robert Chalmers.

CANADA.—Map of a Portion of the Yukon Territory showing Explorations on the MacMillan, Pelly, and Stewart Rivers. Scale, 1:506,880, or 8 statute miles to an inch. *Annual Report* as above.

Illustrates a report by Mr. R. G. McConnell. The work consisted chiefly in an examination of the MacMillan River, about 285 miles long, and one of the principal feeders of the Pelly.

CANADA.—Map of Part of the District of Keewatin showing Survey of the Winisk River. Scale, 16 statute miles to an inch. *Annual Report* as above.

Illustrates a report by Mr. William McInnes, who, in 1903, surveyed the Winisk River, about 340 miles in length. In its upper course the river is interrupted by many rapids.

CANADA.—Orographic Map showing Contour of Lower Slope of Turtle Mountain, Manitoba. Scale, 1½ statute miles to an inch. *Annual Report* as above.

This map, illustrating a survey by Mr. D. B. Dowling, is contoured to show intervals of twenty-five feet difference in elevation over the lower slope and 100 feet in the higher parts. The economic importance of this survey relates to beds of coal or lignite.

ASIA.

ASIA.—Stanford's New Orographical Map of Asia. (4 sheets.) Scale, 1:8,721,500, or 137.6 statute miles to an inch. Compiled under the direction of H. J. Mackinder. Edward Stanford, London, 1906. (Price, coloured sheet, 16s.; mounted on rollers and varnished, 20s.)

This map is one of the excellent series of orographical school maps of the continents now being issued by this house. The map, like those which preceded it in this series, was compiled under Mr. Mackinder's direction from original materials, chiefly the Government surveys. Six tints show elevations from sea-level to more than 15,000 feet above the sea, and 7 tints show depths from sea-level to more than 15,000 feet below sea-level. The drawing of the contour lines at the same intervals above and below sea-level will enable the student easily to compare the great positive and negative features of the regions, such as the high plateau of Tibet and the abysses of the Ocean, east of Japan. We know of no wall map which more graphically depicts the continental land-forms and the varying depths of the bordering oceans than this physical map of Asia. The drainage is in deep blue; and though the primary purpose of the map is to depict the physical features of the continent, the employment of a gray, almost transparent, lettering make it possible to insert many geographical names without blurring the topographical details.

India.—River Hooghly, Calcutta to Saugor. (3 sheets.) Scale, 1:80,724, or 126 statute miles to an inch. From Surveys made by the officers of the River Survey Department under the direction of E. W. Petley, Deputy Conservator of the Port. Calcutta, 1904-05.

Gives the detailed results of the surveys of the Hooghly from Calcutta to the Bay of Bengal. The many hundreds of soundings are in feet, and all heights are expressed in feet and decimals.

AUSTRALASIA.

New Zealand.—Topographical and Geological Plans of the Mahinapua, Kanieri, Turiwhate, and Browning's Pass Survey Districts. Accompanying the Report on the Hokitika sheet of the North Westland Quadrangle. Scale, 80 chains to an inch. *Bulletin* No. 1 (new series) New Zealand Geological Survey, Wellington, 1906.

These are sheets of the detailed topographical and geological map of New Zealand whose preparation has begun in the survey as reorganized by Dr. J. M. Bell, the new Director. The topographical plans give the effect of relief, and indicate swamps, mountain peaks, edges of bush, etc. The wish may be expressed that future sheets will give elevations above sea-level of many valleys as well as of mountain summits. On the geological plans the relief detail of the topographic plans is omitted, and geological information is indicated by colours and signs. All facts are very clearly expressed, though it is not quite so easy on these sheets to compare geological with topographical details as in our geologic folios.

EUROPE.

England.—Bartholomew's Road Surface Map of London and Neighbourhood. Scale, about 2 inches to a mile. John Bartholomew & Co., Edinburgh, 1906. (Price, 2s. 6d.)

The map is mounted on cloth and folded to pocket size. It belongs to the finest class of road maps. Thin, black lines divide it into mile squares and facilitate the estimating of distances without referring to the scale. The area covered extends from Tottenham in the north to Hampton Court in the south and from Abbey Wood in the east to beyond Twickenham in the west. The road-colouring shows whether the highway is wood, asphalt, macadam, or cobblestone. Tramway routes and recommended approaches and main routes are distinguished from other highways. The scale is so large that the entire street plan and the names of the streets of London are printed clearly. The map fully meets the needs of wheelmen and others who require a road map of London and its immediate suburbs.

HUNGARY.—Specialkarte des Balaton-Sees und Seiner Umgebung. Part I, 4 sheets.) Scale, 1:75,000, or 1.18 statute mile to an inch. Planned by Ludwig von Lóczy. Sheets produced by the Imperial and Royal Military Geographical Institute, Vienna, 1903.

These sheets form a topographical and cultural map of Lake Balaton and its surroundings, produced in the admirable style of this Government map-house. A very large amount of detail is given, such as vineyards, forests, mills driven by steam or water, manufactories, limekilns, railroads distinguished as one and two track roads, and highways of various degrees, from the very best roads to footpaths.

RUMANIA.—Carte de Roumanie. No scale. *Annales des Mines,* Paris, April, 1905.

Illustrates an exhaustive monograph, "L'Exploration du Pétrole en Roumanie," by M. Aron. Shows the geological formations in the petroleum regions of the kingdom, the localities where petroleum is found, and cross sections of some of these districts. The existence of petroleum in Rumania has long been known; but its exploitation began only in 1860, when 3,000 tons of raw oil were produced. The product in 1903 was 384,000 tons, and in 1904, over 400,000 tons, Rumania now holding the fifth place among oil-producing countries, though its share of the total product is only a little over 1 per cent.

ATLASES.

ATLAS OF THE WORLD'S COMMERCE.—Compiled from the latest Official Returns at the Edinburgh Geographical Institute. Edited by J. G. Bartholomew. (Parts 11, 12 and 13). George Newnes, London, and Frederick Warne & Co., New York, 1906. (Price per Part, 25 cents.)

With Part 11, half of the complete issue of this Atlas is now ready. Part 11 contains seven maps showing the distribution of the world's fisheries and the productive areas of maize and oats, rice and rye, the potato and manioc. Statistical diagrams, with accompanying text, give the average production of and trade in fish. A new feature is a review of those regions in which wide areas are still undeveloped and which are capable of adding largely to the supplies of the commodities most in demand. The Dictionary of Commodities is completed in this part.

Part 12 has maps showing the distribution of barley, millet, sago, cocoa, and spices. Nine inset maps give information relating to cocoa and spices on larger scales. Coloured diagrams, with descriptive letterpress, give details as to the production and consumption of these commodities. The first four pages of a monograph entitled "An Introduction to Economic Geography," by Mr. George G. Chisholm, appear, and the paper will be continued in the following numbers. Mr. Chisholm defines the scope of economic geography, shows what is included under the heads of the production, transportation, and exchange of commodities, and how geographical considerations arise with reference to them.

Part 13 includes two world maps, showing the distribution of 16 kinds of precious stones and of the pearl and coral fisheries, and three maps showing the areas of cultivation of flax, hemp, jute, ramie, and other fibres, with the distribution of flax cultivation in Europe on a larger scale and the centres of linen manufacture. The descriptive letterpress and diagrams are devoted to these commodities and to petroleum. Mr. Chisholm's monograph, "An Introduction to Economic Geography," is continued.

BOOK NOTICES.

Katalog der im Jahre 1903 bekannt gewordenen Erdbeben. Im Auftrage der Kaiserlichen Hauptstation für Erdbebenforschung zu Strassburg i. Els. Zusammengestellt und herausgegeben von Prof. Dr. E. Rudolph. Mit 7 Karten. Leipzig: W. Engelmann, 1905.

Even those persons who have some familiarity with the subject of seismology will be surprised to learn that a book of 333 double pages is required merely to catalogue in tabular form the reported earthquakes of a single year that were of sufficient magnitude to be perceptible to human senses. The list is necessarily incomplete, reports from some stations not being prompt enough to be included; but the records of 4,760 quakes are given, and many of the shocks were of importance. New Zealand is not represented, and evidently too few shocks have been reported from South America. The data published in the volume are arranged in columns giving the place, date, time, kind of shock, intensity, duration in seconds, direction of movement, accompanying phenomena, area of disturbance, time (mean Greenwich) and place of registration by seismograph, remarks upon the character and effects of the shock, and, finally, the source of information. The quakes are arranged chronologically.

The care with which the catalogue has been prepared may be inferred from the treatment of the question of the place and time of the occurrence of the shock. The place-names have been verified as to position and spelling. The times are all given as they stand in the original reports, except that afternoon hours have been changed when necessary to conform to the 0 to 24-hour clock-reading. On account of the various time-standards used in different parts of the world, a column has been introduced into the tables which gives the correction to be applied to reduce the reported time to mean Greenwich time, and the entries in the tables are in the order of the corrected times. An interesting feature of the distribution of the earthquakes according to time of occurrence is that 1,782 shocks were reported for the first quarter of the year, 943 for the second quarter, 1,034 for the third quarter, and 1,001 for the fourth quarter.

Seven sketch maps show the area of disturbance of that number of the strongest and most interesting earthquakes. These maps illustrate the zones of intensity, direction of propagation and other features of the earthquakes of Vogtland, 13 February to 18 May; southeastern Alps, 16 February; western Siberia, 12 March; southeastern Austria, 20 March; Eger in Hungary, 26 June; Portugal, 9 August, and lower Danube country, 8 June, 13 September, and 26 November.

The volume attempts no further analysis of the formidable array of statistics that it contains, but such an accurate record is of the highest value to the science of seismology and to the general student of earth phenomena; the more so as it is the first comprehensive or rather world-embracing list to be published. It would not have been feasible without the initiative of the Imperial German central earthquake observatory at Strassburg, and it was undertaken on the suggestion and through the efforts of the director of that observatory, Geheimer Oberregierungsrat Lewald. At the time of the publication of this volume there remained to be published the records of the microseismic disturbances, or those which were too weak to be caught except by instruments of high delicacy and precision.

E. O. H.

The Climatology of the United States. By A. J. Henry. United States Department of Agriculture, Weather Bureau, Bulletin Q. 4to. Washington, D. C., 1906. pp. 1012. Pls. 34. Figs. 7.

The situation regarding the publication of climatological data for the United States has been very unsatisfactory. Meteorologists abroad have frequently, in private conversation and correspondence, as well as in print, found fault with the Weather Bureau—and justly, too—for not publishing, in one volume, in fairly complete form, such data as are universally regarded as essential to an adequate understanding of our climate. To be sure, the Annual Reports of the Chief of the Weather Bureau contain, from year to year, summaries of the ordinary meteorological records for the year, and usually also some tabulations for longer periods of different important climatological data not otherwise accessible. But since Blodget's famous classic, "The Climatology of the United States," published in 1857, there has been no attempt to collect, in one volume, with adequate discussion, complete summaries for the different meteorological stations scattered over the United States. Teachers and students who have sought anything like a fairly complete presentation of the climatology of the United States have been forced to search through many volumes of the Reports of the Chief of the Weather Bureau, Weather Bureau Bulletins, publications of the various State sections of the climate and crop service of the Weather Bureau, and the like—in short, the task has been burdensome, time-consuming, and highly unsatisfactory.

At the Washington meeting of the International Geographic Congress, held in September, 1904, Professor A. J. Henry presented a paper on "A Climatological Dictionary of the United States," in which he announced the forthcoming publication of a report, such as that which has so long been needed. The announcement was welcomed in Europe, and for the past year many workers in meteorology in various parts of the world have been waiting for the appearance of the volume, the proof-sheets of which—through the courtesy of Professor Henry—are before us. We may say that we accord this publication a very hearty welcome, because of the great help it will be to all teachers of geography; because it will spread sound information among our own people concerning the climatology of their own country, but chiefly because it will tend to silence some of the well-deserved criticisms which have been so often heard regarding our inexcusable inactivity in presenting, in compact form, and according to recognized standards, the results of the many years of observations which are in the possession of the Weather Bureau. As the Chief of the Bureau rightly says in the Preface to this Bulletin: "While climatological observations have been steadily accumulating for the last quarter of a century, the general results are inaccessible, not only to the general public, but also to the majority of students and investigators interested in the advancement of scientific agriculture in the United States. The work herewith aims to present in form for ready reference comparative climatic statistics for the different portions of the United States, accompanied by explanatory charts and text."

The data in this volume cover, generally speaking, the period 1870–1903, and include those collected primarily for weather-map purposes, and also those obtained by the voluntary observers for purely climatic purposes. In the first part of the book we find a discussion, somewhat too brief to be altogether satisfactory, of the general controls of the *climates* (we prefer the word in the plural when applied to so large an area) of the United States; and here we are especially pleased to note the attention paid to cyclonic and anticyclonic control of climate, the classes of cyclones and anticyclones, their tracks, and their control of weather changes. Many illustrative maps accompany this discussion. In a paper read before the Eighth International Geographic Congress, entitled "Suggestions concerning a more Rational Treatment of Climatology," the reviewer pointed out the need of emphasis on the cyclonic and anticyclonic units in presenting climatological data, and gave a series of curves to show how the tracings of self-recording instruments can be used in this connection. Professor Henry gives three figures showing similar curves, illustrating the weather changes accompanying the passage of cyclones and anticyclones across the country. If such typical curves could be discussed for different sections of the United States, we should have a climatology of the United States unique in character, effective in presentation, and easily understood. Such a work we ourselves have had in hand, but have been handicapped by lack of time and by the impossibility of securing the self-recording instrument sheets needed in this investigation.

The discussion of temperature, precipitation, relative humidity, fog, sunshine, and winds is, in the case of temperature, more complete than anything yet presented, and is modelled on the standard series of data set forth by Hann in his well-known "Handbuch der Klimatologie," and long since adopted as the model for all such work. New calculations have been made in several cases, and many new charts are given. We note data regarding the greatest amount of snow which has fallen in any twenty-four hours, which we believe to be new. This textual descriptive portion of the volume covers 84 pages, and includes mention of such phenomena as cold and hot waves, thunderstorms, tornadoes, chinook winds, etc., and at the end some discussion of seasonal variations of the weather. These first 84 pages make up that part of the book which will be most generally read. They present, with the numerous and well-chosen illustrations, an adequate picture of the climatology of the United States for the general reader, or for the student.

Following this text we find General Tables, including the following: monthly and annual mean temperatures for selected stations; absolute maximum and minimum temperatures for selected stations, with year of occurrence (1871–1903); monthly and annual mean maximum and mean minimum temperatures for 32 stations; absolute range of monthly mean temperatures at selected stations; monthly and annual mean precipitation for selected stations; average number of days with 0.01 inch or more of precipitation for selected stations; monthly and annual mean relative humidity for selected stations; mean monthly and annual percentages of sunshine; prevailing winds for selected stations. After these general tables, and occupying by far the larger part of the volume, come condensed summaries, grouped by the different sections and States, for the regular and voluntary observer stations of the Weather Bureau, with a brief statement as to the location of each station; the duration of the record; the exposure of the instruments, etc. A special discussion, usually very brief, but in some cases quite extended, of the physical features and of the climate of each State, precedes the tables, which include monthly seasonal and annual means, and dates of temperature extremes, usually for the period Jan. 1, 1894, to Dec. 31, 1903.

Our notice of the "Climatology of the United States" has been extended to a rather unusual length, but we feel that the volume is of such importance that it deserves such distinction. Several suggestions as to changes, additions, or improvements will doubtless occur to any one who examines the *Bulletin* critically. As for ourselves, we prefer to welcome this most useful compilation as a great advance on anything which we have had hitherto, and abstain from such suggestion except in one case. We do not find specific mention in all cases of the methods of reduction employed in constructing the climatological charts, nor of the fact whether the observations were reduced to the same period of time. These matters seem to us of fundamental importance, and one of the most thoroughly-justified and most frequently-made criticisms of our climatological work in this country concerns this very matter of publishing data and charts in which the observations were not reduced to the same periods of time. But, on the other hand, we now have something, where previously we had hardly anything. The work, as we happen to know, was carried on by Professor Henry under many disadvantages, and in the midst of other duties. As it stands, it represents a body of material of immense value, now rendered accessible to any one who wishes to secure it. This *Bulletin* will certainly help greatly in the advance of a more rational and systematic study of the climatology of the United States. It will receive a hearty welcome at the hands of climatologists the world over.

R. DeC. W.

Climatological Atlas of India. Published by the Authority of the Government of India under the Direction of Sir John Eliot, K.C.I.E., F.R.S., late Meteorological Reporter to the Government of India and Director-General of Indian Observatories. Issued by the Indian Meteorological Department, 1906, fol. Pp. XXXII. Pls. 120. (Price in the United Kingdom, 36 shillings.)

It is surely seldom that a reviewer has so wholly satisfactory a task as that which falls to our lot in calling attention to the new *Climatological Atlas of India*—a work of art of the highest order of cartographic excellence, and a climatological publication which must certainly rank among the very foremost of all the volumes which have been devoted to climatology or to meteorology. This *Atlas* at once recalls the magnificent *Atlas of Meteorology* (Vol. III of Bartholomew's *New Physical Atlas*) of 1899; for these two volumes are much alike in size and in the general excellence of their make-up, the well-known house of Bartholomew, in Edinburgh, having produced the charts in both of them. It also brings to mind the fine climatological atlas of the Russian Empire, of the year 1900, published by Rykatcheff, Director-General of the Central Physical Observatory at St. Petersburg, as a memorial volume in commemoration of the fiftieth anniversary of the foundation of that institution.

The *Climatological Atlas of India* was prepared by Sir John Eliot, lately Meteorological Reporter to the Government of India, a man widely known for his activities in that trying position, and for numerous publications on the meteorology of India. The data used in the preparation of the charts are chiefly those recorded during the first twenty-five years (1876–1900) of the operations of the Indian Meteorological Department. We learn from the Preface, to our great satisfaction, that a Handbook of the meteorology of India is now in course of preparation, in which a full statement of all the more important features of the climates and weather of India will be given and which will supplement the Atlas. Together these two volumes will give a presentation of the meteorological conditions of India without a parallel in any part of the world. Meteorological work and investigation in India have for years been known the world over. From the time of Piddington's famous "First Memoir on the Law of Storms," published in 1839, the names of many Indian meteorologists who have made a mark in the progress of the science have become familiar—*e. g.*, Wilson, Chambers, Dallas, Hill, Blanford, and Eliot. Last, but certainly not destined to be least, comes Dr. Gilbert T Walker, the present Meteorological Reporter to the Government of India, who, although but recently called to that important office, has already shown that he is the right man in the right place, and that he will be a worthy successor to Blanford and Sir John Eliot. Fascinating India certainly is in its unique variety of climates ; in its stupendous problems of famine and flood ; in the possibility of vast benefit to millions of men in the accurate forecasts of its monsoon rains. To be able to study Indian climatology with such a body of charts as are here collected is a pleasure which it is hoped many will enjoy.

The *Introduction* gives a short history of meteorological observation and organization in India, including a list of publications of the Meteorological Department and a list of the observatories, and then follows a brief, compact, and thoroughly satisfactory discussion of the charts. Plate I is a splendid general orographical map of India, the colouring of which is admirably adapted for bringing out the geographic details which are important in an understanding of the meteorology. Several cross-sections help to make clear the principal features of the topography. Other plates show the political, rainfall, medical, and meteorological divisions. Two large charts showing, for Southern Asia and the Indian Ocean, the isobars and winds for January and July are followed by smaller charts of pressure and wind for 8 A. M., 10 A. M., and 4 P. M. for each month and for the year; also by monthly and annual charts of mean pressure and wind for the day, of actual diurnal range, and of diurnal range reduced to sea-level. The temperature charts include the following: mean daily temperature, mean maximum, and mean minimum for each month and the year; diurnal range, absolute maximum, and absolute minimum for each month and for the year. Relative and absolute humidity and cloudiness are shown for each month and for the year (mean daily, 8 A. M. and 4 P. M. means). The rainfall charts include monthly and annual charts of normal precipitation and of the number of rainy days; seasonal rainfall, number of rainy days, and noon pressure at 10,000 feet for January-February; March to May; June to October; November-December; December-April, and May-November. Storm tracks are shown with particular detail on monthly charts.

These 120 plates are coloured with that good taste and effectiveness which characterized the charts in the *Atlas of Meteorology*. For our own part, we have no single adverse criticism to make. A good many of the maps present details which are not commonly charted or expected; but the need of their inclusion in this *Atlas* is established by the name of the compiler, and they certainly contribute greatly towards making the *Climatological Atlas of India* a volume of extraordinary excellence and value. This *Atlas* takes a very prominent place in the splendid series of *Memoirs* and other publications of the Indian Meteorological Department. R. DEC. W.

Structural and Field Geology: For Students of Pure and Applied Science. By James Geikie, LL.D., etc., Professor of Geology and Mineralogy in the University of Edinburgh. New York: D. Van Nostrand Company, 1905, pp. 435.

This exceedingly attractive volume, which deals almost wholly with the side of practical geology, will be welcomed by all—teachers, students, field-surveyors, engineers—who are in any way associated with the study of geology or the interpretation of facts in the field. Judiciously laying aside considerations which are involved in the theories and outer conceptions of geology, the author, whose training and power of lucid exposition have made him particularly fitted for the service which he now gives over to others, enters directly upon the consideration of the structural aspects of rock-formations and their appearance in the field, and follows with explanations regarding their manner and method of occurrence, their deformations and alterations, the laws and conditions which govern these changes, special formations, etc., always maintaining well to the front the practical aspects of every form of inquiry. Concluding chapters are on geological survey, geological aspects and sections, and the economic aspects of geological structure. The book is of a kind that few students in geology can well afford to do without, and it appeals to the specialist through its numerous facts and the force of opinion which their interpretation carries. Differences of opinion which one may hold with the author on certain obscure problems have no place in the review of a book which is replete with information, and which seeks to present chiefly the accepted or recognizable facts in the field. The unusually good quality of the illustrations which illumine the text, vastly superior to what one generally finds in manuals of geology, helps not a little to the attractiveness of this particular volume. A. H.

Handbuch der Geographischen Ortsbestimmung für Geographischen und Forschungsreisende. Von Dr. Adolf Marcuse. x and 342 pp., 54 Illustrations and 2 Star Maps. Friedr. Vieweg & Sohn, Braunschweig, 1905. (Price, M. 10.)

This book is especially adapted for the needs of teachers and students of mathematical geography and for explorers. It deals with the most important and practical methods of determining time, latitude, longitude, and azimuth. Though the extension of geographical surveys is continually adding to the number of points whose position has been fixed by triangulation, there are still large parts of the world where these fixed points are not available for starting a survey, and it is therefore necessary for the surveyor himself to establish the positions between which he measures his baseline. Before going into the field, therefore, it is highly desirable that the explorer or traveller should master the best methods devised for this purpose. Dr. Marcuse's book supplies the student who has the preliminary mathematical training required with the textual assistance he needs.

After treating of the astronomical-geographical bases of surveying, Dr. Marcuse describes and summarizes the most important nautical almanacs and ephemerides in use, and the tables of logarithms, etc., which lessen the labour of computing the observations. This is followed by a very complete and well-illustrated account of the principal instruments used. The second half of the book is given to descriptions in detail of the methods used in determining geographical positions.

Nouvelles données sur la Zone Littorale d'Angola. Par Paul Choffat. (Contributions à la Connaissance Géologique des Colonies Portugaises d'Afrique, No. 2), 4to, 78 pp., 4 Plates, illustrating fossils, and 3 Figures in the Text. Comm. Geol. Portug., Lisbon, 1905.

One difficulty in depicting the geology of Angola has been the inadequacy of the maps, which, as yet, are on too small a scale to show the results of detailed geological study, and, in other respects also, are misleading. For example, the largest scale map (1:1,000,000) shows the railroad line in operation from Loanda, not where it was actually built, but along the route as at first projected. The results of geological investigation along the coast show that this zone of Angola, from Ambriz to the south of Mossamedes, consists of sandstones, probably Palæozoic, strata of the Cretaceous, Tertiary strata, probably Miocene, and superficial deposits. Little is yet known of the tectonic conditions that helped to produce the surface forms. A large part of the text is palæontological.

Handbuch der Erdbebenkunde. Von August Sieberg. xviii and 362 pp., 113 Illustrations, Maps and Index. Vieweg & Sohn, Braunschweig, 1904. (Price, M. 7.50.)

The author treats the phenomena of earthquakes, the methods of studying them, the instruments used in their investigation, and the mathematical and theoretical sides of the subject. Many pictures, diagrams, maps, and tables are included in the text. While the book is scientific, it is well arranged, simply written, and is intended primarily as a handbook for the laity. The large amount of data, methodically presented, makes it also a convenient manual for scientific men. The work is almost encyclopædic. It even includes a few pages on the question of earthquake prediction—a topic that is historically interesting, though the author emphasizes the statement that, in the present condition of seismology, there is no such thing as accurate prediction of earthquakes.

The many phases of the subject which are treated at length include a discussion of the kinds of earth movements; the geographical distribution of earthquakes, including a concise, classified statement of the most important shocks within the historical period (our great earthquake of Aug. 31, 1886, is assigned to Charleston, *N.* C.); the classification of earthquakes, according to origin; nature of the shocks as to energy, duration, periodicity, etc.; influence of earthquakes upon the earth's crust, water, and buildings; phenomena accompanying earthquakes; seaquakes (25 pp.); instruments used for recording and measuring earthquakes; methods of investigation (30 pp.), including the determination of the epicentral tract, of the force exerted at the epicentrum and other illustrations of the mathematical treatment of problems; and the historical development of earthquake investigations, including the present observation service in all countries, the distribution of seismic observatories, the number and kind of seismographs used at each station, etc. This scholarly compendium should be in the hands of all who are interested in the subject.

Camp-Fires in the Canadian Rockies. By William T. Hornaday, Director of the New York Zoological Park. xvii and 343 pp., 70 Illustrations by John M. Phillips, 2 Maps, and Index. Charles Scribner's Sons, New York, 1906. (Price, $3.)

This is one of the best "Outing" books that have appeared in our country for years. Mr. Hornaday spent some time in the fall of 1905 among the superb mountains of southeast British Columbia between the Elk and Bull Rivers, which seem to be the special paradise of the mountain goat and certain other wild creatures. This region, a little north of the Kootenay mining district, has not been over-described, and the grand aspects of nature, together with the interesting animals found there, are well worthy of a book. Mr. Hornaday's special purpose was to study the mountain goat, one of the most remarkable of animals; and it was to his great advantage that his companion was Mr. Phillips, the State Game Commissioner of Pennsylvania, an expert with the camera, who has produced many pictures for this book that have rarely been equalled. The whole expedition was a grand success. Hundreds of mountain goats were seen, and some of them were photographed with the animals only four to twelve feet from the instrument. A number of these views are really startling, for Mr. Phillips often clambered out on the almost precipitous face of the rocks in his enthusiasm to secure good negatives. They were secured at risks to life and limb, and the reader will probably agree with Mr. Hornaday that Mr. Phillips was too venturesome.

Mr. Hornaday says that the mountain goat in some respects is the bravest and hardiest of our hoofed animals, and the only one that is practically devoid of fear. Very few have recognized it as an unrivalled mountaineer :

> It is my belief that no animal, hoofed or clawed, can surpass the climbing feats of the mountain goat. Certainly there is no American quadruped, not even the bold and hardy mountain sheep, which will, with the utmost indifference, climb an eighty-degree precipice, or jog across the face of a five-hundred-foot wall on a footing so narrow and uncertain that the strongest glass cannot detect it.

About half the book is given to the life and ways of this animal. Mr. Hornaday's map shows that its habitat extends as far south as northwest Wyoming and as far north as the mountains in the Mount Wrangell region of Alaska. Few mountain goats have thrived in captivity; but Mr. Hornaday brought five young ones east with him, and when he was writing his book they were in the best of health.

The book also contains most readable chapters on grizzly bears, which are becoming so scarce in our country that sportsmen have to go to Canada to hunt them; on the mountain sheep and other game, the wonderful trout fishing, and other features of the trip which made it delightful and a source of recuperation to all concerned. The author is in closest and most intelligent sympathy with the life of the great wilds, and this makes what he says both authoritative and pleasant to read. He writes of all these animals as their friend and not their foe. He killed some of them, but only for important purposes; and he expresses the wish that the Canadian laws for the protection of big game may be more stringently enforced and that the number of animals which one man is permitted to kill in a year may be reduced. The publishers have produced the book very handsomely.

Die Gründung von Deutch-Ostafrika. Kolonial-politische Erinnerungen und Betrachtungen. Von Dr. Carl Peters. v and 276 pp., 14 Portraits and Index. C. A. Schwetschke & Son, Berlin, 1906. (Price, M. 4.)

Dr. Peters had a most prominent part in opening a vast territory in East Africa to German governmental control and to the colonial enterprises of his countrymen. Results of value are constantly accruing, and the aspirations of Peters, Jühlke, and other pioneers for the development of this region as a German possession are being fully realized. The book tells the story of pioneer effort in this virgin field; and it will be welcomed, not only for the history it records, but also because it is from the pen of a man who was foremost in making that history. Peters gives full credit to the good work of the men who participated in his labours, though he unsparingly criticizes one or two who did not meet with his approval. The book will be a valued source of information on the beginnings of German colonial enterprise in East Africa.

The excuses which Dr. Peters makes for the bloodshed by his Emin Pasha Relief Expedition on his march to Victoria Nyanza fail to wipe out the stain. This subject was threshed out long ago, and the only comfortable thing to say in relation to it is that that record of slaughter by a white expedition is probably unexampled in other annals of African exploration.

Die Reformation der Kartographie um 1700. Von Christian Sandler. With Atlas of Facsimile Maps. R. Oldenbourg, Munich and Berlin, 1905. (Price, M. 20.)

The Academy of Sciences in Paris was the leading agency in the reformation of cartography. The work was begun systematically in the last twenty-five years of the seventeenth century. Delisle's maps of the world and the continents, which were produced on the borderland between the seventeenth and eighteenth centuries, mark the climax of this great work of cartographic improvement; and with the production of the last of these maps, about 1720, the participation of the Academy in the reform may be said, in a sense, to have terminated. Dr. Sandler, in a thorough and scholarly manner, has traced the progress of this reform through its various steps, assigning to each man his proper place in it. He has thus given a clear and consecutive history of a movement which resulted in the great improvement of cartography.

The two most conspicuous errors of the early cartographers were that they represented the Indian Ocean as a closed sea (a blunder that was corrected by the discovery of the sea route to India) and their great exaggeration of the extension, east and west, of the land-masses. Sailors had long insisted that the land, especially in the Mediterranean regions, was shown on the maps as reaching too far east and west, but most of the cartographers still held to their old methods of computing longitudes. There was much confusion and blundering in this respect.

Dr. Sandler shows how the progress in astronomical science gradually supplied better bases for fixing longitudes, and that even before Cassini showed the way to the determination of longitude by means of observations of the satellites of Jupiter such men as Kepler, Varenius, and others had computed many geographical positions with a nearer approximation to accuracy than had previously been made. Cassini's tables (1668) gave additional facilities, and the French took up the work of the more exact determination of longitude. The culmination of their work was reached in the achievements of Delisle, who devised some new cartographic methods which contributed to notable results; and one of the most valuable parts of Dr. Sandler's work is his discussion of Delisle's methods.

The accompanying map-portfolio contains facsimile reproductions of Delisle's maps and some notable maps of an earlier date. Traced on transparent paper overlying each map are the outlines of the continents and some of the larger islands as they are known to-day. It is thus easy to see how far and in what detail these early maps differ from those of to-day in the position and shape they give to the large land-masses. It is a demonstration of the fact that Delisle's maps approximate the truth much more closely than others made very near his time and, indeed, in the early days of this reform movement. Dr, Sandler's able contribution to the history of this transforming period in the development of cartography will be very widely appreciated by students of the development of geographical science.

Geography of Nebraska. By George Evert Condra. viii and 192 pp., 118 illustrations from photographs, Maps and Index. The University Publishing Company, Lincoln, Nebraska, 1906.

Dr. Condra is Associate Professor of Geography and Economic Geology in the University of Nebraska. Such books as this one on Nebraska and that which Prof. Hall has written on Minnesota, are needed. There is great lack of first-rate geographical literature relating to the various States. This little book on Nebraska presents to the boys and girls, in an edifying and attractive manner, the geography of the great region in which they are chiefly interested. It is also adapted for those general readers who do not need a fuller treatment of the subject; and for all readers, so long as the geography of the State is not completely treated in any book.

The introductory chapter gives a general idea of the scope of the book. It is followed by ten chapters dealing with the geological structure—the story of the origin of the rock formations, the weather, climate, water, and drainage basins of Nebraska, its four topographic regions—viz., the loess, sand hill, and plain regions, and the bad lands. Then follow chapters on the settlement and development of the State, a summary of its resources and industries, and of the methods for reclaiming the dry, wet, or sandy lands that are unfit to produce farm crops (irrigation, drainage, forestation, dry farming, and drought-resisting crops), and descriptions of the cities and towns. The book is primarily intended for use in graded schools. One of its best features is the close connection maintained throughout between geographic conditions and human development.

Le Partage de l'Océanie. Par Henry Russier. xi and 370 pp., Illustrations and Maps. Vuibert & Nony, Paris, 1905. (Price, 7.50 fr.)

In the past twenty years events have tended more than ever before to make the Pacific a centre of international politics. Among these events have been the development of large interests pertaining to the United States and Germany. The history of colonial enterprise has recently been told by Dr. Supan; and now comes this volume by Dr. Russier. It is a rather more extended treatment of the same subject, and is an important compilation of facts dealing with the Pacific Islands, their inhabitants, and their relations with the white race from the earliest times to the present day. The volume is a fine specimen of book manufacture, abounds with beautiful photographic illustrations, and its maps, though merely black-and-white sketches, are fairly adequate for the essential needs of the reader.

In the first 94 pages the author gives a carefully-written account of the genesis of the archipelagoes, their natural conditions, and their indigenous populations. The following 88 pages are devoted to a concise but complete history of the voyages of discovery for three centuries, beginning with the sixteenth; of the development of missionary enterprises and the political results of these religious and educational movements; of the rivalries that grew up between the European nations which, through missionaries and teachers, had secured a foothold, and of the resulting conflicts and international competition. The remainder of the work, about 175 pages, is given to the development of the French, English, United States, and German colonies.

The author has little faith that France will long continue to exercise important influence in this part of the world; but he believes that brighter prospects await the enterprises of the United States and Germany, which, he says, have the means of communication to keep in close touch with all their Pacific interests. He thinks, however, that the appearance of Japan as a colonial Power in the Pacific cannot be viewed with complacency by other nations, and is, to say the least, a disquieting fact.

Ostasienfahrt. Erlebnisse und Beobachtungen eines Naturforschers in China, Japan, und Ceylon. Von Dr. Franz Doflein. xiii and 511 pp., Maps, Illustrations, and Index. B. G. Teubner, Leipzig, 1906. (Price, M. 13.)

The book tells the story of a naturalist's experiences and observations in Oriental waters. It is intended for intelligent readers generally, and is one of those works, increasing in number, which give a popular account of scientific labours. Dr. Doflein made the journey in 1904, with the special purpose of investigating fauna along the eastern Japanese coast, which not only offers unusual forms peculiar to that region, but also contains an admixture of marine life belonging to waters of more northern latitudes, and also to those of far southern regions. It is here that the Kuro Siwo, or the warm current flowing north along the coast of Japan, meets the cool Kurile current from the north, and the observer found that here the relations between the northern and southern fauna might well be studied. The result of his investigations, however, seems to show that there is no sharp boundary between the migrations of the southern and northern faunas, and that the change from one to the other takes place gradually, and all along the eastern coast of Japan. Dr. Doflein thinks that the reason for this is that the north and south flowing currents intermingle and change their position with the time of the year.

He found that the fauna in Sagami Bay to the south of Tokio is remarkably rich, owing, doubtless, to large supplies of food, due to mortality among the surface organisms which perish on account of the change of temperature where the two currents meet. He says that many of the so-called deep-sea forms of life may more properly be regarded as still-water forms; for their great need is absence of motion in their environment rather than any other of the peculiar conditions of the deep sea. He thinks that their vertical range will be found to be considerable when the middle depth of the seas has received the same attention from oceanographers that has been given to the deep sea and the surface waters.

On his journey home, Dr. Doflein visited Ceylon, and he tells many interesting things about his studies of the fungus-growing termites and the spinning ants on that island. Other chapters deal with the customs and ways of the various peoples met on the journey, and especially in Japan. The volume belongs to the best class of scientific writing designed for the general public. It has been produced in the best style, and many of the illustrations have much merit.

Aus Busch und Steppe. Afrikanische Expeditionsgeschichten. Von Adolf v. Tiedemann. 251 pp., and 57 illustrations, Winckelmann & Söhne, Berlin, 1905. (Price, M. 3.)

The author was one of the companions of Dr. Carl Peters on the German Emin Pasha Relief Expedition in 1889–90. Dr. Peters encountered enormous difficulties on this journey, from the mouth of the Tana River to the Victoria Nyanza. He had repeated fights with the Massai and other peoples, and was severely criticized, on his return, for his treatment of them. The results of the journey have been fully published, and Mr. Tiedemann's own impressions of it have appeared in print. The present book, however, is also well worth reading. It consists of a number of sketches of life and incident during that gruesome march. These sketches are of a nature to relieve the monotonously unpleasant records of the unfortunate expedition. The author has literary talent and the gift of humour, which he infuses into his account of some incidents of that long tramp that may be treated in light vein. There are other stories, such as "Christmas in Massai Land," that have strong dramatic interest, and are well told. The sketches are evidently honest narrations of things that actually happened, and they throw a sidelight on characteristic and also unusual incidents of caravan travel that are enjoyable, and often valuable bits of information. The illustrations are admirable.

Au Pays des Pyrénées. By Emile Daullia. 8vo. Charles Mendel, Paris, s. a.

It is not easy to classify this new book by the author of the "Tour du Mont-Blanc." There is a good deal of light geography in it, considerable about the author himself, especially in the first half; long and not strictly amusing or enlightening conversations with hotel people, apothecaries, alpine amateurs, and guides, and much nomenclature scattered through very attractive descriptions of landscape. It may be said that one-half of the book is devoted to cities and their monuments cursorily alluded to, the other half to the country and its mountains. The French Pyrenees are treated in a sort of panoramic way; now and then a peep at the Spanish part of the chain is interpolated. In short, it is pleasant and light reading, and the photographs are handsome.

Mr. Daullia does not pretend to specialism in mountains and mountaineering. What we detect in his plan of writing is, a rather careful survey of the *surroundings* of the particular range that interests him. Those surroundings are seldom treated in the manner in which he attempts it; they are mostly disposed of in a rapid way, as mere preliminaries to the main subject, or in the dry guide-book or geographical handbook style. The author introduces them to us with a great deal of detail, enlivening it by personal items not always indispensable, but sometimes very characteristic and useful. After reading him we feel that we know something concerning the base and approaches to the core, and feel even tempted to believe that, thus prepared, we might attack that core itself. It is a new departure in alpine literature, already announced in his previous work, but carried further and brought out more clearly in this one. We may regret, perhaps, that he does not enter into greater detail about the numberless points of historic interest, offered by the cities of southern France, which he traverses. But antiquities are not his field, and monuments appeal to him only as salients upon the relief-chart of nature.

In judging of the Pyrenees, Mr. Daullia naturally drifts into a comparison of their scenery with the Alps. He places the former on a level much lower than that of the latter. We may well conceive that a mountain chain, less elevated and massive, will not come up to the standard of one that forms the pinnacle of a continent. Still, others have allowed to the Pyrenees a style of natural beauty and grandeur that might hold its own alongside of the Alps. chiefly on account of its differentiation in type. Properly speaking, no two regions can be fairly compared with each other. Each has its merits that are peculiar to it, its charms in which the other is lacking. The personal element comes in for a great deal also. Not only does one landscape appeal to one person more than to another: the mood and the circumstances under which the observer is placed influence and bias the judgment. The Alps are certainly grander, on the whole, than their more modest neighbours, but the book of Mr. Daullia itself convinces us that the latter are, in many ways, worthy corollaries of the former, and deserve the attention of the lover of nature, the seeker of alpine sport, the investigator, and the student of man's past and present.

AD. F. B.

The Land of Pardons. By Anatole Le Braz. Translated by Frances McGostling. Illustrated. 8vo, Macmillan Co., New York, 1906.

Beautiful and well-chosen illustrations, photographs, and charming water-colours by Gotch adorn this pretty little volume. The translation has been a labour of love; the translator was prompted to it by her fancy for the land, admiration for the author's talent, and interest in the subject. And the unpretentious volume, indeed, deserves to be translated.

That the "Pardons" of Brittany are religious celebrations is well known. An authority says about them: "They have remained unchanged for over two hundred years, and nowhere else will you find anything so deliciously obsolete. They have no resemblance to other festivals. They are not pretexts for feasting, like the "Flemish Kermesses," neither are they revels like the Paris fairs. No! their attraction comes from a higher source. They are the last vestiges of the ancient Feasts of the Dead, and there is little laughter at them, though much prayer." The greater portion of the day is spent in devotional exercises, there is mostly a procession, and towards evening some modest festivities set in, ending in a dance. The peculiar character of the Bretons shows itself on these occasions; rather demure, sober, and quiet, even in rejoicing and love. That these survivals from olden times will pass away there is no doubt—the author confesses that they have already changed much in the last twenty years—hence it is fortunate that he observed them long ago, when they were still altered, and has recorded what he saw with the impartiality and in the kindly spirit that, towards religious performances, is so out of fashion among many.

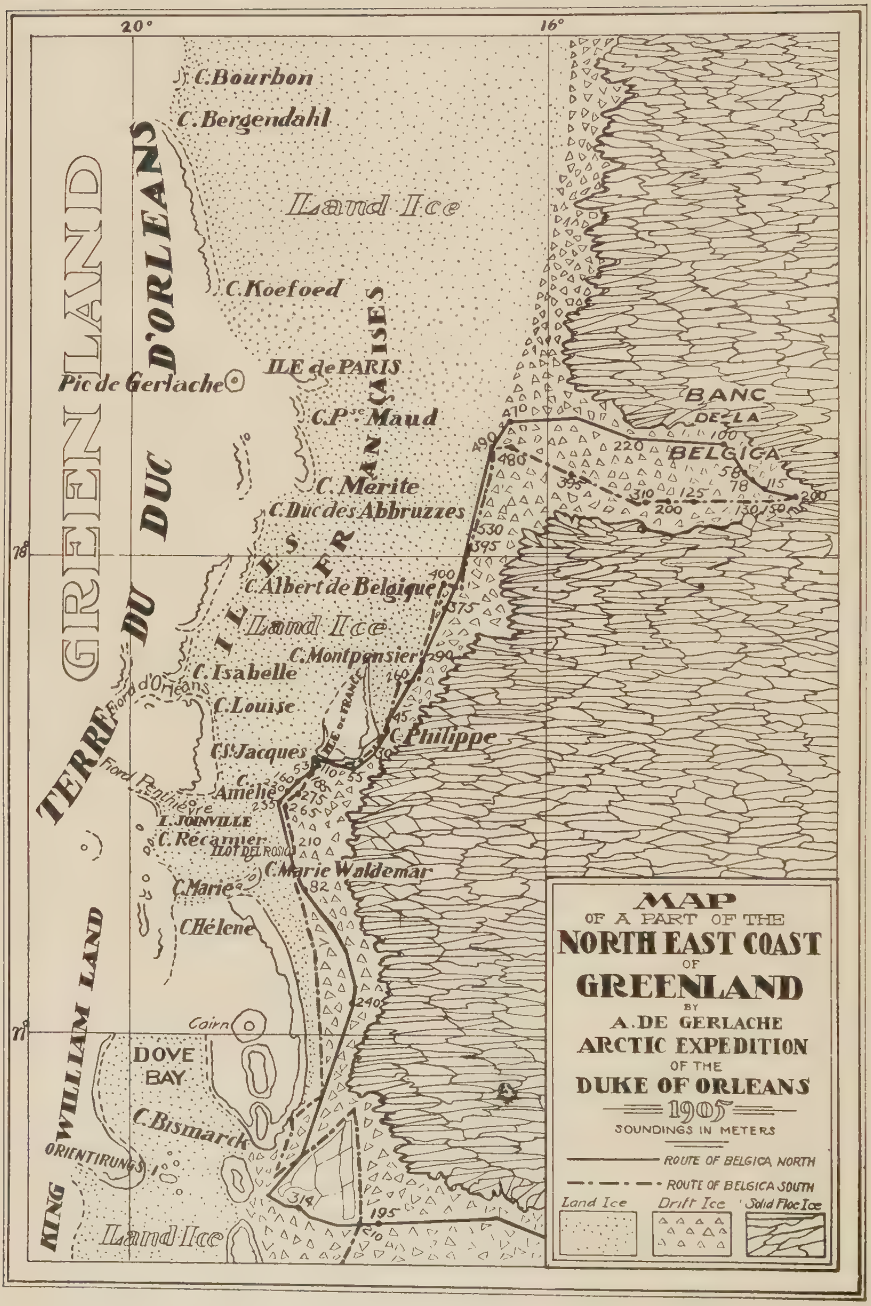
He has taken occasion of the "Pardons" to record a number of old legends of saints and of miracles, from early and later medieval days. In the faithful preservation of these lies the chief value of the book. Hardly any of them is known outside of Brittany, and many harbour traces of historic traditions. They are told with charming simplicity, in a manner and style perfectly harmonizing with the subject, and the personages introduced as authorities for them, the tellers of the tales, find their place in the frame of the story as naturally as the beautiful illustrations in the text. While the book does not, and cannot, claim to rank among scientific literature, it still has considerable ethnologic merit, and no student of Brittany, of its past and present, can overlook it. The translation seems to be, if not unimpeachable, yet commendable. It is no easy matter to render such works in a foreign language without occasional failings.

To compliment the author on his work would be superfluous. His name and fame are established; but we can thank the translator for the service she has rendered, by placing it within reach of an English public. AD. F. B.

Travels through the Alps. By the late James D. Forbes, F.R.S., Sec. R.S. Ed., F.G.S. New Edition, Revised and Annotated by W. A. Coolidge. Portrait, New Maps, Illustrations and Diagrams. 8vo. London: Adam and Charles Black, 1900.

The book of Forbes is so widely known and has been reviewed so often that it suffices to recall its great importance without more comment than to draw attention to this enlarged new edition as by far the most valuable, since the editor, the Rev. Mr. Coolidge, is a most eminent authority himself, and has not only corrected the inevitable errors of the original—errors that cannot be charged to the author, since the information was not at his command—but has added a wealth of data entirely new. This makes of the book of Forbes the most valuable source on studies of the glaciers in the regions of which it treats, not excepting the exhaustive work of Heim, which covers more ground, but is not based upon so much practical acquaintance with the subject. Criticisms are uncalled for, and merely in order to escape a possible reproach of partiality shall we notice two slight objections. One is certainly due to an oversight of the printer or proofreader. On page 98 a "portable telescope (*Feldstecke*) by Ploessl" is mentioned. It should be *"Feldstecher."* The footnote on p. 79 also reads somewhat curiously. Treating of the sheep pasturing about the Mer de Glace, the editor rises to the comment: "Accordingly, here and elsewhere, a traveller may be incommoded by the importunate earnestness with which the sheep surround and follow him, supposing he has brought salt with him. They are as tame as domestic animals." We have always thought sheep were classed among domestic animals in general, like horses, cattle, and others that associate with man. They are certainly looked upon as such in Savoy, Switzerland, and, as far as we know, even in England. With the exception of the mouflon, Europe has no wild species.

Some of the maps in the older editions of this book have been replaced by more recent ones, thoroughly improved, while a few have been omitted for good and valid reasons. AD. F. B.


20°
16°
C. Bourbon
C. Bergendahl
Land Ice
C. Koefoed
GREENLAND
TERRE DU DUC D'ORLEANS
ILES FRANÇAISES
Pic de Gerlache
ILE de PARIS
C. Pse Maud
C. Merite
C. Duc des Abbruzzes
78°
C. Albert de Belgique
Land Ice
C. Montpensier
C. Isabelle
Fiord d'Orleans
C. Louise
ILE DE FRANCE
C. Philippe
C. St Jacques
C. Amelie
Fiord Penthièvre
I. JOINVILLE
C. Récamier
ILOT DEL ROSIO
C. Marie Waldemar
C. Marie
C. Hélene
Cairn
77°
DOVE BAY
C. Bismarck
ORIENTIRUNGS I.
KING WILLIAM LAND
Land Ice
BANC DE LA BELGICA
470
490
480
220
100
58
78
115
200
395
310
125
200
130
150
530
395
400
375
290
160
45
30
53
110
55
160
188
275
230
235
265
210
82
240
314
195
210
MAP
OF A PART OF THE
NORTH EAST COAST
OF
GREENLAND
BY
A. DE GERLACHE
ARCTIC EXPEDITION
OF THE
DUKE OF ORLEANS
1905
SOUNDINGS IN METERS
ROUTE OF BELGICA NORTH
ROUTE OF BELGICA SOUTH
Land Ice
Drift Ice
Solid Floe Ice

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THE NORTH-EAST COAST OF GREENLAND, BEYOND 77° N. LAT.

In the summer of 1905 the Duke of Orleans chartered the Belgian exploring ship *Belgica,* made a cruise in the East Greenland Sea, reached the coast of Greenland in the neighbourhood of Cape Bismarck, the most northern point fixed by the Koldewey expedition, and ascended the unknown coast for about 120 miles (BULL. of the Amer. Geog. Soc., 1905, pp. 672-3). A paper on this exceptional voyage, written by Captain de Gerlache, leader of the Belgian Antarctic expedition, who accompanied the Duke, is published in *La Géographie* of the Paris Geographical Society (Vol. XIV, No. 3, September, 1906).

The chief purpose of the Duke's expedition was to make oceanographic studies in the Greenland Sea between Spitzbergen and Greenland. This part of the Arctic Ocean to the north of the 77th parallel was practically unknown, and few precise soundings had been secured away from the coast of Spitzbergen. The *Belgica* was, therefore, provided with the equipment of a modern oceanographical expedition. It was little expected that she would be able to cross the Greenland Sea from Spitzbergen in unusually high latitudes.

The following facts concerning the *Belgica's* voyage are condensed from Captain de Gerlache's paper; and our map is reduced from one of his two maps, published by *La Géographie.*

The *Belgica* left Tromsö for Spitzbergen on June 3, 1905. After spending several weeks along the west and north coasts of this archipelago, a course was taken to the northwest, and on July 9 the pack ice was reached in 80° 20′ N. Lat. and 5° 40′ E. Long. The edge of the pack was followed to the southwest, in the hope that an opening might be found through which the ship could reach the Greenland coast in a high latitude. The experience of the whalers in the great days of that industry was that the coast could best be reached through the ice between 72° and 74°; but polar navigation has no absolute law, and the expedition desired to ascertain if the pack could not be traversed at a much higher latitude.

The numerous soundings secured on this southwestern voyage along the edge of the pack ice were the first to be obtained in the central regions of the Greenland Sea in latitudes between 75° and 80° N. A little above the 78th parallel a depth of 2,700 meters was found; nine miles further west the depth was 2,100 meters; 19 miles further west it was only 1,425 meters. About 70 miles south of these soundings, on nearly the same meridian, the depth decreased from 2,600 meters to 1,275 meters in a few hours' steaming. These soundings indicate a submarine ridge extending roughly north and south.

The course was now mainly west not far from the 76th parallel. A little west of 10° W. Long. soundings of 340 meters with gradual shoaling further west showed that the continental shelf had been reached. Here the ship rounded the southern terminus of the impenetrable pack and made its way to the northwest and west.

On July 28, in 77° 5′ N. and 17° 50′ W. the *Belgica* passed within four miles of the cairn erected in 1870 by Koldewey and Payer on the coast of King William Land. But these explorers attained this northing only after a difficult sledge journey of 150 miles from the winter quarters of their exploring vessel *Germania*. They were twenty-two days on the way north, and the cold was intense. The *Belgica* party, on the contrary, reached the same point in a good ship offering considerable comfort; and the temperature was 2° C. above freezing. The contrast was striking.

From what they saw of the ice conditions Payer had felt justified in saying that "except under unusual circumstances no vessel will ever advance along this coast." The *Belgica* had met these exceptional circumstances. For a time there was no impediment to progress northward, excepting fog. Between the impenetrable pack ice and the land ice, which was still solidly attached to the coast, there was a channel full of floating ice, but still navigable.

No time was lost in starting northward in this channel. The explorers felt their way along through the mist past Cape Bismarck. The fog prevented them from seeing the Greenland coast, but frequent soundings gave them some clew to their distance from it. Then the fog suddenly lifted, and they saw, to the west, the Greenland coast, and in the northeast a large island or a promontory. This discovery was most joyfully welcomed. A party was sent out over the land ice to this new island, from which the *Belgica* was seven or eight miles' distant. They reached the land, which was christened L'île de France, and made a rapid reconnaissance. The island is an old moraine, rising gently to a height of 160 meters. The southern slope, which was easily ascended, was almost bare, while the interior and northern slope were covered with névé. The promontory at the southeast end of the island received the name of Cape Philippe (77° 38′ N. and 17° 36′ W.).

Although on the rocky surface there was but little soil, the flora was more abundant and varied than that of the islet of Marussia (south of Cape Bismarck), and nineteen phanerogamic plants, seven varieties of moss, four of fungi and six lichens were added to the collections. They found many white hares and in the snow traces of foxes and geese. A lemming was captured. At the highest point of the island a cairn was erected, and a record placed.

Returning down the slope, they found a little worm-eaten structure that puzzled them very much. No trace of a camp could be found, and the rough surface thereabouts was not favourable for erecting tents. The explorers, therefore, came to the conclusion that what they had found was the remains of a fox trap rather than of a human habitation. However this may be, the evidence of the former presence there of Eskimos has its importance, as strengthening the hypothesis that the nomad tribes which reached Greenland from the North American archipelago finally attained the east coast of the island by passing around its northern end.

Around the ship flew terns, petrels and gulls. Now and then a bearded seal (*Phoca barbata*) was seen. During the night numerous narwhals came out from under the winter ice that extended between the Greenland coast and the Ile de France. They swam towards the south in schools of six or seven.

On July 29 the *Belgica* was moored to the land ice near the west point of the island (Cape Saint Jacques). While waiting for the fog to rise so that they might fix the position of this promontory, they took a series of oceanographic observations and secured specimens of plankton. On July 30 the fog was less dense and they could dimly see the island. They weighed anchor in the morning and skirted the coast to determine the orientation of the southern shores of the Ile de France. At 11 o'clock they reached Cape

Philippe. Thick ice extended from the shore. Hugging the outer edge of this ice, they gradually lost sight of the island, and did not know till the fog lifted that they had been following the land ice. Soundings were kept up at intervals of two hours and distances of about six miles. They found depths of 45 meters, then 290, 375, 395. They were getting away from the land and were steering to the N. 15° E.; but about 11 P. M. the wall of ice they had been following since morning turned more to the east and they had to steer to the N. 30° E.

At midnight they reached 78° 16′ N. and 16° 48′ W. They were then 167 miles to the north of the extreme point previously attained on that coast by an exploring vessel (*Germania*, 75° 29′ N., July 27, 1869). It was about the highest point they could reach. The fog, lifting for a moment, enabled them to gaze over the sea. It was covered with heavy ice. They could not push much further towards the north. Undoubtedly, they might have added some minutes of latitude to their record, but they could not run the risk of being caught in the ice, for they were not prepared to spend the winter in the Arctic. They desired, however, to utilize their exceptional position by taking a few soundings further east.

At midnight on July 31 the lead showed 470 meters. At 4 o'clock the next morning, fifteen miles further east, the sounding was only 220 meters. Three hours later bottom was found at 100 meters. Things were becoming interesting. The ice was growing more compact and the *Belgica's* prow had to be turned to the southeast. At 11 A. M., about 30 miles east of the midnight position, the depth was only 58 meters, and pebbles were brought up. They had discovered a morainic bank, which they named the Belgica Bank. They thought they might be in the neighbourhood of an island, for they saw two ravens and a walrus, and these animals are never found far from land. The explorers were eager to elucidate this interesting problem, but circumstances compelled them to leave it to others. The fog lowered again; to the north and east the ice had become almost impassable, and nothing more could be done there except to take a few soundings in the east-south-east. In this direction the ice was a little more practicable, yet it formed such a maze of channels that in the fog it was difficult to find a way through. The soundings showed 75 meters, then 115 and 200 meters. An observation of a horary angle enabled them to fix the longitude of the last sounding at 13° 36′ W. The latitude was estimated at 78° 7′ N. They were forty miles east of the coast of Greenland, in the midst of the great white space left on the map by earlier explorers.

The pack was becoming more and more unmanageable, and it was decided to regain the Ile de France, in order to fix its position a little more precisely. The explorers sounded frequently during the rest of the day. At 11 P. M. the fog lifted a little and they saw to the west the reflection of the land ice and of the land projected on the sky in two strata, the "iceblink," all white, and the "landblink," a yellowish white; then the fog veil became still thinner, and very elevated land appeared in the distance. Seaward the cloud banks hung low on the ice, and their hope of seeing the land, whose existence had been suspected, was disappointed.

On August 1 the pack was rather more navigable, and the route was slightly inclined to the north, in order to catch a glimpse of the most northern land to be seen from their position. At 4 o'clock they reached the ice wall they had skirted the day before. It was the edge of the land ice, and they made fast to it to take the bearings of land that was in view. The land ice formed a solid field covered with soft snow, in which they sunk to their knees. The ice stood from 1½ to 2 meters above the sea and its edge extended about N., 15° E. The edge was nicked with breaks and cracks made by the floating ice brought down by the polar current. There was little evidence that pieces of the land ice are detached from the mass by thawing. The mass had every appearance of stability. To the south of Ile de France, however, the land ice had a very different aspect. It emerged above the sea only thirty to forty centimeters. Ravages had been made by melting, and the uneven surface enclosed great pools of water. Large pieces detached from the land ice moved off to mingle with the polar pack.

During the morning the floating ice moved along the edge of the land ice, carried to the northward by a current of 275 meters an hour. In the afternoon, however, the drift was towards the south at a rate of movement only one-third as great. The *régime* of flux and reflux currents was recognized here, one of them nullifying and even more than counteracting the polar current and the other accelerating its rate of movement.

At 2.30 A. M. on August 2 the lower part of the land appeared; then, little by little, the fog veil was completely lifted. They saw before them an immense panorama of the Greenland coast, stretching from 80 to 90 miles. Mérite took advantage of this opportunity to catch a detailed view of the coast, while Bergendahl and de Gerlache took a series of bearings. At 5 o'clock the *Belgica* cast off and proceeded south along the land ice.

The day was radiant, and at 4 P. M. the thermometer marked

3.8° C. The men were quite warm. After doubling Cape Philippe, the vessel was moored at the edge of the land ice near Cape Saint-Jacques. Next day, in fine weather, the position of Cape Saint-Jacques was determined—77° 36′ N., 18° 10′ W. A round of angles was also taken from this point.

On the beach, near the point of observation, they discovered one of those circles of stones carefully placed together, in which earlier explorers thought they recognized "tent circles." The Eskimos have a habit of securing their tents by placing stones in a circle around them. It seemed to the Duke of Orleans and his comrades, however, that when the Eskimos struck camp and folded their tents, they would not be careful to leave exactly in a circle the stones that had held their tents to the ground. In their opinion these circles did duty rather as the foundations of snow huts. They discovered no other evidence of the existence here of Eskimos. They found, however, on Cape Saint-Jacques a musk-ox skull and a bit of drift wood. They saw also ravens, a skua and a sea woodcock (becasseau de mer).

In the morning a strong south current carried the floating ice against the edge of the land ice, and before the explorers could cast off their hawsers the *Belgica* was completely closed in. The rudder was considerably damaged and, for several hours, the expedition was in an unpleasant situation. In the afternoon, however, with the aid of the wind, they were able to get out of the ice and continue the voyage south.

On August 4, they made fast to the edge of the land ice, and the Duke of Orleans and Dr. Récamier, with a few of the men, started west for a trip over the ice to Cape Amélie. The ice was rapidly breaking up, but, in spite of many obstacles, they nearly approached their destination when they found that the land ice was detached from the coast, and, as they had no boat, they were forced to beat a retreat. The party returned after twelve hours, greatly fatigued by their difficult march over the spongy ice. Though they missed the satisfaction of planting their flag upon this point of the Greenland coast, they gained at least the impression that Cape Bismarck is not a promontory of the mainland, but is the southern point of a large island. On this day numerous narwhals passed the ship in schools of five or six, swimming south in the morning and north in the afternoon; or, in other words, against the current each way.

The accompanying map, showing the part of the coast of East Greenland between 77° and 79° N., was the result of a very rapid reconnaissance carried out under unfavourable conditions: "We show on this map what we saw and probably not all that is really there." Cape Bourbon, which seemed to be an island, was observed only from one point, and that was from the masthead. Only one azimuth was available to fix the position of Cape Bergendahl. All the other salient points of the map were the result of two or more compass bearings. Noteworthy points mapped as capes may be promontories, or perhaps they are simply elevated areas behind the coast, and they alone came into view. Are the white spaces which separate them fiords or wide valleys? The *Belgica* explorers express no opinion on many such questions. As far as they could conjecture, both from what they saw and from what is known of the coast regions to the south of 77° N., the part of the East Greenland shore between 77° and 79° N. is penetrated by deep fiords, many of which doubtless communicate with one another in the interior. The lands are covered with an immense sheet of ice (the inland ice), above which black rock escarpments are sometimes seen. Glaciers may, perhaps, be found in the ravines; but the explorers saw no evidence that glaciers descend to the sea, except in the case of the local glacier, which moves down the southeast slope of the Ile de France. No true iceberg was seen in the Greenland Sea.

It was impossible to give careful attention to tidal movements along the coast, though while the ship was moored to the land ice there was conclusive evidence that the currents to the north of Cape Bismarck alternate, one of them flowing to the north and the other more rapidly to the south. To the south of the Ile de France, where the waters are not affected by the great polar stream, the alternating currents appeared, other things being equal, of the same intensity, and they are evidently the tidal currents.

The coast ice to the south of the Ile de France differs from that to the north. In the south it is annual or, in other words, it forms every winter, while in summer part of it disappears by melting and a part drifts away in large floes. In the north it seems to be always attached to the coast and to be reduced chiefly by the grinding action of the floating ice. Along the edge of this land ice, both to the north and to the south of the Ile de France, was a channel sufficiently free from ice for navigation.

On August 5 a landing party reached the land a mile north of Cape Bismarck, where the ruins of an Eskimo village were found. They consisted of a dozen stone circles and three graves. The shore was barren, but a little above it was vegetation in considerable variety, and a little inland there were even pastures. The explorers were surprised to find no sign of the musk ox here. They saw, however, many traces of the hare and lemming, also of snow buntings, terns, and sandpipers. Next day they landed again at the southern point of the largest of the Koldewey Islands (Cape Arendts), a low point of morainic origin, which extends seven or eight miles further south than is shown on the German map. The channel between the islands and the Greenland coast was still entirely covered with winter ice. Floating ice massed compactly to the north and east of Shannon Island compelled the Duke of Orleans to forego his intention of visiting this island, and also prevented a near approach to Franz Josef fiord. The season was now far advanced, the nights were cold, and sometimes the sea was covered with young ice. It was time to reach the open sea.

On August 12 the sun disappeared for a few minutes below the horizon. The *Belgica* was steaming south in pack ice that now was easily navigated and then was quite compact. Everything was enveloped in dense fog.

On August 15 the *Belgica* steamed east, and on the 17th in 70° 38′ N. and 15° 22′ W. she felt the ocean swell. The wind was fresh from the southeast, and the ice was massed in wide belts. The fog hid the surface of the pack and the channels through the ice. At 2 P. M. on the 18th the ship reached a compact belt of ice, which was thrown into long undulations by the swell. At 8 o'clock that evening the open sea was reached, and four days later the *Belgica* anchored in the harbour of Reykjavik.

During six weeks in the Greenland Sea there were 482 hours of fog; that is to say, in the proportion of one day to two. The maximum frequency of fog occurred while crossing the pack from July 21 to 27 and from August 15 to 18. Really fine weather was exceptional. From July 22 to August 8 the temperature was above zero (C.), though frequently near the freezing point. The lowest temperature was —3.4°C. on July 16 at 4 A. M., and on August 9 at 2 A. M.; the highest temperatures were +7.2°C. on July 27 at 2 P. M. and +7.1° on August 7. The humidity was generally near the point of saturation. Very frequently the weather was perfectly calm, and the force of the wind was usually less than ten meters a second.

The ice pack in the summer of 1905 certainly presented very favourable conditions for navigation. The experience of the *Belgica* is corroborated by that of the Norwegian sealers. In May and June they found the edge of the pack ice more to the east than usual, and, being spread out more, the ice was less compact than in earlier years. About the end of May the yacht *Excelsior,* from Tromsö, found the pack ice very scattered and penetrated 120 miles into it to 75° 30′ N. Two other vessels, the *Söstrene* and the *Severin,* crossed the pack and reached land early in July near Shannon Island. They found an ice-free channel along the coast, three to four miles wide, which they followed northward almost to Cape Bismarck, which no ship had reached before. The *Belgica* crossed the pack at a higher latitude than any ship before it had done. It was not easy, however, to keep the ship going in these latitudes; and if it had not been for the wish of the explorers to add new soundings to the map, they would have chosen an easier route from 50 to 100 miles further south. On the other hand, after they had made Cape Bismarck, no serious obstacle impeded their northern voyage to 78° 16′ N.

Eighty soundings were made, many of them in an unexplored zone; in fifty soundings temperatures and specimens of water were obtained at different depths; plankton was also secured at various depths at several of the stations. East Greenland was for the first time connected with Spitzbergen by a complete series of oceanographical observations. These observations have been co-ordinated in the Bergen laboratory with those of the same kind made by the International Commission for the Exploration of the Sea.

The meteorological observations which were made every two hours during the entire cruise were sent to the Copenhagen Meteorological Institute for comparison with those taken at the Danish stations in Iceland and Greenland. Captain de Gerlache says that Mr. Mylius Erichsen, who is now supposed to be with his expedition on the east coast of Greenland, will doubtless modify to an important extent the hasty reconnaissance of the *Belgica* party. The work of the *Belgica,* however, supplied useful information to Mr. Erichsen and proved the feasibility of his plans.

The technical results of the cruise will be brought out by the Duke of Orleans in a handsome publication early in 1907.

THE TENTH INTERNATIONAL GEOLOGICAL CONGRESS.

BY

E. O. HOVEY.

The Tenth International Geological Congress met in the building of the Instituto Geológico Internacional, Mexico City, from the 6th to the 14th of September inclusive, under the protection of President Diaz, and the honorary presidency of Sr. A. Aldasoro, Minister of Fomento, Colonization and Industry. The officers of the Congress were: President, Dr. José G. Aguilera, Director of the Geological Survey of Mexico; vice-presidents from each of the countries represented at the Congress; general secretary, Dr. Ezequiel Ordoñez of the Geological Survey of Mexico; and treasurer, Dr. J. D. Villarello, likewise of the Mexican Survey. More than 300 of the 500 members of the Congress were enrolled as being present at the meetings or taking part in the excursions. Twenty-one nationalities were represented among the delegates in attendance. About thirty papers were read in full or in abstract during the sessions in addition to the reports of the several standing committees, and twenty-eight papers were listed in the official programme for reading by title only. The extemporaneous discussions in the sessions of this Congress were particularly full, interesting, and valuable.

The opening session was held in the "Salon des Actes" of the National School of Mines, and was an impressive function, with the President of the Republic, Ministers of State, members of the Diplomatic Corps, and present and past officers of the Geological Congress occupying the platform, and with many prominent citizens of Mexico present with the congressists in the audience. After the addresses of welcome, the election of permanent officers, and the adoption of the programme voted by the council, the Congress adjourned to hold its scientific sessions at the new building of the Instituto Geológico Nacional. The first of these sessions was given over to communications on miscellaneous subjects, and the following papers were read: "Ueber das ältere Mesozoicum Griechenlands," by Doctor C. Renz of Breslau; "The Onyx Deposits at Etla, State of Oaxaca," by Dr. K. Keilhack of Berlin; and "On the Concurrence and Inter-relation of Volcanic and Seismic Phenomena," by Professor A. Heilprin of Philadelphia.

Professor Heilprin's general conclusions were that a broad inter-relation exists between volcanic and seismic phenomena generally: that inter-related eruptions and earthquakes may occur at places hundreds, or even thousands, of miles apart; that tectonic earthquakes are only doubtfully to be distinguished from those of volcanic origin; that seismic and volcanic disturbances seem to be the expression of one common interior telluric strain or condition, and that this condition may in some or many cases be clearly associated with a pronounced magnetic or electro-magnetic quality of the planet; that superficial movements of the crust in connection with earthquakes are effects, not causes of disturbances. The paper was discussed by Messrs. Lawson, Becker, and Reid, none of whom could accept the conclusions of the author.

A report that will be of particular interest to American geologists was that of the committee appointed by the Geological Society of America at the Ottawa meeting (1905) to prepare a general geological map of North America. The committee consisted of Messrs. I. C. Russell (chairman), J. G. Aguilera, Bailey Willis, F. D. Adams, and C. W. Hayes. The report consisted of the completed map and two explanatory pamphlets by Messrs. Willis and Aguilera. The United States Geological Survey furnished the funds needed for publication, but the Mexican Government contributed toward defraying the expenses by purchasing a certain number of copies of the map for distribution among the delegates present at the Congress. The nomenclature adopted for the map is that of the U. S. Geological Survey, with which, unfortunately, the nomenclatures of the Canadian and Mexican Surveys do not correspond. The publication of this map is the first adequate step which has been taken toward filling a long-felt want. Professor A. C. Lawson, of the University of California, criticised the map for the manner in which the term Algonkian is used, saying that Eo-Algonkian is there made to comprise eras which are separated by the great Post-archæan unconformity, whereby an event of the utmost importance in the geological history of the North American continent is obscured.

Professor T. W. E. David, of the University of New South Wales, at Sydney, read a most interesting paper, illustrated with lantern-slides, on the glaciation of Australia during Palæozoic time. Striated erratic boulders occur in Lower Cambrian beds, but *roches moutonnées* have not been found. Striated boulders and *roche-moutonnéed* surfaces have been found in the Permo-Carboniferous strata of Australia, as well as in India, South Africa, and South America, indicating the wide extent of this Palæozoic glaciation. There has been found, too, evidence of Pleistocene glaciation in Australia. In another paper Professor David announced the discovery of diamonds in the matrix at Oakey Creek, Inverell, New South Wales.

In a paper entitled "Ueber die Klimaänderungen der geologischen Vergängenheit," Professor F. Frech of Breslau elaborated the theme that the climatic evolution of the world from Palæozoic times to the present epoch has always been in certain correlation with the changes in the proportions of carbonic acid gas and water vapour in the atmosphere. Increase in the amount of these two factors present in the atmosphere is due to volcanic exhalations, while decrease is caused by organic and inorganic chemical combinations, particularly the latter. General L. de Lamothe of Grenoble read a paper on "Le Climat de l'Afrique du Nord pendant le Pliocène et le Pleistocène." Dr. Marsden Manson of San Francisco read E. W. Hilgard's paper on "The Causes of the Glacial Epoch," in place of his own communication on "Les Climats des Temps Géologiques."

The foregoing topic, "Conditions of Climate in the Geological Epochs," was the only one of the several broad questions announced for consideration at the Congress which was discussed in at all the manner expected by the Committee of Arrangement. Most of the disputants listed for the four set topics failed to attend the meeting—a fact that was embarrassing to the Committee and disappointing to the Congress. Through an unfortunate misunderstanding the men whose names appeared on the programme were not called upon by name to open the discussion of geological climates, so that some carefully-prepared papers were not read, although their authors were present. Those who actually took part in the discussion on climates were Messrs. Philippi, Burckhardt, Frech, Rothpletz, Diener, Kerner, Vorwerg, Coleman, Allorge, Davis, Fairchild, Becker, Heilprin, and David. Professor G. Stefanescu of Bucharest gave a description of a complete skeleton of *Dinotherium gigantissimum* Stefanescu, the first remains of the species having been found by the author in 1888 at Manzati, Roumania.

The topic "The Origin of Ore Deposits" was considered in the following set papers: "Some Relations of Paleogeography to Ore Deposition in the Mississippi Valley," by Dr. H. F. Bain of Springfield, Illinois; "Sur la Relation entre l'État Propylitique (Grünstein) des Andésites et la Genèse des Filons liés à cette Roche," by Dr. B. von Inkey of Buda-Pest; "Ore Deposits at the Contacts of Intrusive Rocks and Limestones, and their significance as regards the general formation of veins," by Professor J. F. Kemp of New York; "Sur le Remplissage de quelques Gites Metallifères," by Dr. J. D. Villarello of Mexico; "Origin and Classification of Ore Deposits," by W. H. Weed of New York; and "Ore Deposition and Depth," by W. Lindgren of Washington. On account of the great development of the mining industry in Mexico and the keen practical interest in the quéstion, such an array of papers naturally aroused animated discussion, which would have been much extended had time allowed. Those who took part in the discussion, aside from the authors of the papers read, were Messrs. Lawson, Becker, Bergeat, and Freudenberg.

The communication of J. G. Andersson, "On the Principal Results of the Swedish Antarctic Expedition," was read by Professor H. Sjögren of Stockholm, and illustrated by many interesting lantern-slides. Professor A. Heilprin of Philadelphia described the present condition of Mt. Pelé, as seen by him on a visit to Martinique last spring, and re-stated his belief that the new dome and spine are the solidification-plug of a previous eruption, pushed up to the surface during the series of eruptions that began in 1902. He considers this view to be proved by the coarsely-crystalline character of the fragments of the spine now to be found on the sides of the dome. The paper was illustrated with lantern-slides of new and old views. Dr. Tempest Anderson followed with an exhibition of lantern-slides from his photographs made on the Island of St. Vincent in 1902.

A timely paper was one by Professor A. C. Lawson of Berkeley on "The San Francisco Earthquake of 1906," in which were given the principal results thus far obtained by the State Earthquake Commission, of which he is chairman. The paper was illustrated by striking photographs showing the effects of the horizontal movement along the fissure which caused the quake, as well as the disastrous results of the vibrating motion in directions transverse to the fissure. Another timely communication, and on a subject not so familiar to American readers, was that by Dr. V. Sabatini of Rome "Sur la Dernière Éruption du Vésuve." The eruption was characterized by the enormous amount of ash and lapilli thrown out, which was thicker in a zone passing through Ottajano than it was either nearer the vent or farther away therefrom. The highest observed rate of flow of the lava streams was 66 meters per minute. It was estimated that 63,000,000 cubic meters of solid material were emitted by Vesuvius during the April eruption. Sand-flows like those of Pelé and mud-flows were noted. Dr. Sabatini's paper was illustrated with lantern-slides showing the main phenomena of the eruption, and was followed and supplemented by Dr. Tempest Anderson with a series of excellent stereopticon views of the same series of outbursts and their effects. In a paper entitled "Efemérides del Volcan del Colima," Presbyter S. Diaz of Guadalajara gave a résumé of continued observations of the outbursts of the volcano before, during, and after the eruption of 1903, and showed the great desirability of the establishment of a permanent observing station on that volcano. The other papers on the programme as read were: "Ueber den Verlauf der Geoisothermen in Bergen und seine Beeinflussung durch Schichtstellung, Wasserläufe und chemische Processe," by Professor J. Königsberger of Freiburg; "Interglacial Periods in Canada," by Professor A. P. Coleman of Toronto; "Geologic Classifications in the North Central Portion of the United States," by N. H. Darton of Washington; "Coon Butte, Arizona, its Meteoritic Origin," by Professor H. L. Fairchild of Rochester, N. Y.; and "The Western Sierra Madre of the State of Chihuahua," with lantern-slide illustrations, by Dr. E. O. Hovey of New York.

The International Committee on Glaciers reported through its chairman, Professor H. F. Reid of Baltimore, that the work of recording the movements and other phenomena of modern glaciers had been carried on systematically, and was being extended. No report was received from the "Committee on the Geological Map of Europe." The Committee on the Palæontologia Universalis reported through Professor F. Frech of Breslau that the work was being carried forward satisfactorily, and the Congress adopted his recommendation that the Committee expand the scope of its work to cover the republication entire of fundamental treatises in palæontology. Vacancies in the committee were filled by the election of Dr. R. Ruedemann for the United States and Drs. E. Böse and C. Burckhardt for Mexico.

The Committee on International Coöperation in Geological Investigations reported by letter through its chairman, Sir Archibald Geikie of England, that progress had been made toward conservation of energy along these lines. The Spendiaroff Prize was awarded to Dr. Th. Tschernyschew for his work entitled "Die Obercarbonischen Brachiopoden des Ural und des Timan." The following Committee was announced for the awarding of the prize for the next Congress: *Mexico*, Messrs. Aguilera (chairman), Böse, and Burckhardt; *United States,* Messrs. Osborn and Walcott; *Great Britain,* Sir Archibald Geikie; *France,* Professor Barrois; *Germany,* Professor Frech; *Austria,* Professor Diener; *Russia,* Dr. Tschernyschew. The theme proposed for the next competition for this valuable prize is "Description of a Fauna in connection with its Evolution and Geological Distribution." The suggestion of the Committee of Organization that the Congress publish an International Geological Review through subsidizing the Geologisches Centralblatt was referred by the Council to a Committee consisting of Messrs. Tschernyschew (chairman), Credner, Tietze, Low, Hayes, Barrois, Teall, Pellati, Aguilera, and Holm to report at the next Congress. The Council also adopted a strong recommendation to the next Congress that the excursions be confined to geologists, and elected a committee to formulate a plan for the more rigid supervision of matter offered for publication in the Compte-Rendu. The Congress adjourned to meet in Stockholm in 1909, or 1910, as may best suit the convenience of the Swedish committee.

The social side of the meeting was well cared for by the Mexicans. The evening before the beginning of the sessions was devoted to an informal dinner at the Chapultepec Restaurant, and the evening of the last day to a similar farewell dinner at Sylvain's Restaurant, in the city. Receptions were given at the Geological Institute, the Colonia Maria Club, and by the Minister of Fomento, an elaborate banquet was offered by the City of Mexico at the Municipal Palace, and a reception, followed by a dinner, was given by President Diaz in the Castle of Chapultepec. On the several excursions before, during, and after the sessions some twenty-five banquets were provided for the congressists on most lavish scale by Governors, municipalities, and mining men, and everything was done to make the foreigners feel at home and see all that could be seen in the time available of the geology and mines of the Republic. The Government, too, was practically the host of the Congress on the long excursions, since the fee paid by the participants was only about one-third the actual expense, the remainder being met out of the federal treasury. The Government also provided for half-fare rates for the congressists on all the railways of Mexico and for similar concessions on certain steamship lines from Europe, the United States, and South America.

The most important feature of the International Geological Congress is, probably, the excursions. In this respect the Mexican Congress was particularly good on account of the great variety which could be offered in the lines of vulcanology, tectonic geology, stratigraphy (particularly from the Upper Jurassic upwards), mining geology, and physiography, to say nothing of beautiful scenery, and all sorts of vegetation, from the scantily-covered desert and semi-arid upland to the dense tropical forests of the moist coastal plains of the Tierra Caliente. Ethnologists had several kinds of Indian tribes to observe; while for the persons interested at all in archæology the famous ruins were full of fascination. The rainy season was still on during the period of most of the excursions, which added greatly to the difficulty of carrying out the programmes on account of delays due to soft track and washouts; but very few features of the whole long list were wholly lost. On the other hand, the showers cleared the atmosphere and rendered the mountains more beautiful.

Before the actual sessions of the Congress there were three excursions in south-central Mexico. The first party went to Oaxaca, examining *en route* the Archæan rocks of the cañon of Tomellin under the guidance of Dr. E. Ordoñez. From Oaxaca the great ruins of Mitla were visited, under the leadership of Professor E. Seler, the famous Americanist of Berlin. On the return to Oaxaca the party divided, most of the members hurrying back to Mexico City and thence to Morelia, to join either the Jorullo or the Colima excursion; so few of the original number were left, in fact, that the visits to the fossiliferous (Lower Cretaceous) localities of Zapotitlán and San Juan Raya were abandoned. The second excursion was to the volcano of Toluca, with Mr. T. Flores as leader, and to Jorullo, under the guidance of Dr. Ordoñez. Toluca is fourth in point of height among the mountains of Mexico, being a little less than 15,000 feet in altitude. Its crater contains one of the very highest bodies of water (elevation about 14,000 feet) in North America. The last phase of activity of the volcano was the exudation of a dome of lava within the crater which was too viscous to flow as a stream—the counterpart of the new dome of Mt. Pelé, Martinique. A few of the party climbed to the summit of Xinantihuatl, as the highest part of the rim of the volcano is called, and enjoyed thence a wonderful view of volcanic cones and craters, plains and woodlands, from the dense forests south and west of the peak to snow-clad Popocatepetl and Ixtaccihuatl in the east. From Toluca we went to the beautifully-situated, quaint old city of Morelia, where we joined the excursionists from the hot springs of Agua Fria and the extinct geysers of San Andres, who had had an interesting trip with Dr. P. Waitz as guide, but a very hard one, on account of heavy rains.

From Morelia the Jorullo party, under Dr. Ordoñez, was favoured by good weather and reported a wonderful trip, the members being particularly impressed by the view from the Hacienda Mata de Plátano across the Tierra Caliente to the Sierra Madre del Sur beyond the volcano of Jorullo. From Morelia the Colima party, under Dr. Waitz, proceeded without stop to Zapotlan, it being impracticable to visit the geyser region of Ixtlan on account of the heavy rains, which had rendered the trails impassable for a large party of horsemen. At Zapotlan a day was lost on account of heavy rain in the morning; but Tuesday, August 28, the party was favoured by sufficiently good weather to make the start for the volcano, and the ten-hour ride through the forest over the pass of the Nevado de Colima to the camp at 10,800 feet elevation, fronting the volcano itself, was one never to be forgotten. The view from the pass includes the active cone (12,669 feet in altitude) and the Tierra Caliente below, quite to the Pacific Ocean at Manzanillo and westward. Fourteen of the party climbed to the top of Colima on August 29, and most of the number entered the old summit crater. This crater is filled with the block lava of the 1903 eruption, and through the crevices between the blocks live steam is issuing in such volumes that it would probably be impracticable to reach the top of the new cone within the old crater. The newspaper report regarding injury to the party was entirely without foundation in fact. On Toluca and Colima the geologists found that the State Governments had erected substantial log or slab cabins expressly for their protection against the cold nights, while the Congress guides had made every other provision for comfort.

All the excursionists assembled again in the City of Mexico on September 1, and the following day joined with new arrivals in starting upon the "Excursion to the East." The first day was occupied with the journey to Jalapa, the most interesting feature of which was the view of the recent volcanic phenomena of the Texcoco basin, in which lies Mexico City. The second day the party was divided into two sections, one of which went with Dr. Ordoñez as guide to the Cañon and Falls of Texolo, where is developed abundant electric power for use at Jalapa. The falls are double, consisting of an upper one of 50 feet and a lower of about 100 feet through a rift in the edge of a great flow of andesitic lava. A neighbouring gorge, 256 feet deep and less than 50 feet wide, cut through the same bed of andesite by the main river, is picturesque and interesting. The other section of the party, under the leadership of Dr. E. Böse, went to Carrizal, and there took horses for a ride through the barranca of Santa Maria Tatetla. Palæopliocene fossils were obtained by some of the party, but the principal interest of the day lay in the scenery and the dense tropical forest along the route. The third day was spent at Orizaba and in reaching the plateau again through the famous gorge traversed by the Mexican Railway. The tectonic features of the region were explained by Dr. Böse.

Four single-day excursions were offered gratuitously during the sessions. The first was, on September 7, to the extensive basalt flow known as the Pedregal of San Angel, which is prehistoric as to recorded age, but which came from the region of Mt. Ajusco and overwhelmed human beings and covered pottery in its advance. On September 9 the congressists were the guests of the Geological Society of Mexico on a trip to Cuernavaca, where they were entertained by the municipality at a banquet given in the historic Palace of Cortés. The journey is one that is famous for the beauty of the scenery along the route. Tuesday, September 11, was devoted to visiting the prehistoric pyramids of the Sun and the Moon near San Juan Teotihuacan, where the members of the Congress were the guests of the Minister of Public Instruction and Fine Art. A highly-romantic feature of this day was the dinner given in the grotto "Porfirio Diaz," which is thought to have been excavated by the builders of the pyramids for material for those huge structures. The fourth excursion was given on Thursday, September 13, to the famous silver mines of Pachuca by the Compañia de Minas del Real del Monte y Pachuca, with a banquet at Pachuca given by the Governor of the State of Hidalgo.

Anything like a complete account of the great nineteen-day excursion through the northern portion of the Republic after the adjournment of the Congress would be too long for insertion in these pages, and only an outline sketch can be attempted. The congressists, to the number of 111, left Mexico City Saturday evening, September 15, in two luxurious Pullman trains. The trains were unusually heavy and the track very soft, so that their normal condition was that of being behind time. The first stop was at El Valle de Santiago, where Dr. Ordoñez conducted the party to some of the craters of explosion which characterize the valley. These are volcanic craters which seem to have been formed by single outbursts of steam. The following day, Monday the 17th, was spent at the famous old mining town of Guanajuato, which creeps up the sides of a great gulch and its tributaries four miles from Marfil, the nearest railroad station. Fabulous quantities of silver ore have been taken from the ground in this district. The Congress party was divided into three sections—one for surface geology under Dr. Waitz and two for mines under Messrs. Villarello, Flores, and Robles. It was quite a novel experience to walk down steps for a vertical distance of 800 feet into a mine (the Cata), and it was difficult to realize that for three centuries the only way of getting ore out of that mine was on the backs of men and up those long stone steps.

Tuesday was spent at the attractive little mining city of Zacatecas, where one section of the party devoted itself to the surface geology under the leadership of Dr. C. Burckhardt and saw interesting series of fossiliferous beds of Upper Triassic age associated with schists of possibly greater antiquity and with diabase and intrusive and effusive acidic rocks (quartz porphyry). The Bote silver mine was visited by a group of the congressists, with Mr. Flores as guide. The next day the great lead-silver mine and smelter of Mapimí were seen, with Dr. Villarello as scientific leader. The ores carry much arsenic, and present some interesting problems in treatment, which are being handled in an up-to-date manner. The mines are deep for the country, being worked down to the 700-meter level.

Conejos was the next stop on the programme, and there, under the guidance of Dr. Böse, the party saw the surface geology and underground workings of the only known workable deposit of sulphur in the Republic. The sulphur is associated with a fault in the Cretaceous limestones and marls, and seems to be the result of hot-spring action rather than a reduction from gypsum. Friday, September 21, was spent in and near El Paso, Texas, the geological feature of the day being a reconnoissance of the laccolith and associated fossiliferous Cretaceous beds forming the Cerro de Muleros, with Dr. Böse as guide. Saturday was devoted to the city of Chihuahua, and Sunday to the mines and geology of the vicinity of Parral. Dr. Waitz led the party on the surface; while Dr. Robles led that which visited the Cobradilla silver mine, one of a great group of mines on the important "Veta Colorado," which lies between walls of rhyolite and related rocks.

Washouts prevented the party from going to Parras, and soft track and a washout delayed the trains so that the day was consumed in getting to Saltillo. Between Torreon and Saltillo portions of the Bolson de Mapimí that were said not to have known a drop of water for twenty-five years formed shallow lakes aggregating hundreds of square miles in extent. The three days, September 25-27, which were devoted to the horseback and foot trips from Concepcion del Oro to Mazapil and the Sierra de Santa Rosa formed a memorable part of the whole northern excursion. Study of the geology was under the guidance of Dr. Burckhardt, and included splendid examples of upturned and completely overturned Upper Jurassic and Lower Cretaceous strata and beautiful mineralized zones of the contact metamorphism between the limestones and a large intrusive mass of diorite. Along the contact lie the valuable oxidized and sulphide copper ores which are being exploited by the Mazapil Copper Co., whose mines were visited under the leadership of Dr. Villarello. Friday, September 28, was devoted to Las Esperanzas, Coahuila, where the geological relations of the Upper Cretaceous exposures were explained by Dr. Aguilera; while the coal mines were visited, with Mr. E. Ludlow, of the Mexican Coal and Coke Co., as guide. The coal is of Upper Cretaceous age, and occurs in a bed about six feet thick in three basins near Las Esperanzas. It forms an excellent fuel—for a Cretaceous coal—and much of it is burned into coke. Saturday was spent at Monterrey, where the great smelter, the iron works, and the electric silver reduction plant were visited.

Sunday passed in travel, and Monday was devoted to the geology of the eastern edge of the plateau, from Cárdenas down to the coastal plain. From Cárdenas to Canoas the section was made on foot, with Dr. Böse as leader. The strata are of Upper Cretaceous age, and some of the beds are highly fossiliferous, so that many excellent specimens were carried away by the congressists. The ride from Las Esperanzas to Monterrey, and particularly that from Cárdenas through the Tamasopo and Micos cañons, were impressive in their display of the great thickness of Cretaceous limestone along the eastern portion of the plateau region and the amount of folding and faulting that the beds have suffered. The night was spent at Tampico, and on Tuesday the trains returned through the wonderful cañons, stopping *en route* to allow the passengers to go down into the picturesque Grotto of Choy, which lies directly beneath the railroad track in the limestone escarpment facing the wide coastal plain. A portion of the Congress party, led by Dr. Ordoñez and Mr. Doheny, stopped to examine the oil fields near Ebano, thirty-four miles west of Tampico. The wells are about 425 feet deep, and bring the oil up from Tertiary (Miocene?) beds. The oil is of very high specific gravity, with heavy asphaltic base. Only the gushing wells are utilized at present, and the production is about 1,500 barrels per day. Most of the oil is sold crude to the Mexican Central Railway for locomotive fuel. The remainder is refined, the distillates being sold to the Waters-Peirce Oil Co., and the asphalt being used for pavements in Mexico City and elsewhere. Wednesday was devoted to the smelter at San Luis Potosi and the city itself, and by noon of Thursday both trains had discharged their load of well-satisfied congressists in Mexico City.

Saturday morning, October 6, about sixty-five of the congressists left Mexico City for a visit to the Isthmus of Tehuantepec as the guests of Sir Weetman D. Pearson, the head of S. Pearson & Son, the great English firm of engineers and contractors having in charge the extensive improvements along the Tehuantepec Railway and the harbour works at Coatzacoalcos and

Salina Cruz, which have been provided for by the Mexican Government by appropriations amounting to about $32,500,000 gold during the past five or six years. Seven days were devoted to the trip under the scientific guidance of Dr. Böse, and the complete section across the isthmus was seen from the Pliocene of the Atlantic slope through the upper Miocene and the middle Cretaceous to the crystalline schists and the associated metamorphosed limestones of the heart of the "sierra" between Rincon Antonio and Chivela, the granitic and porphyritic rocks of San Gerónimo, the Archæan gneisses and granites of Tehuantepec and the granitic intrusive rocks of Salina Cruz. The excursionists were greatly impressed with the extent and completeness of the preparations made at both harbours and along the railroad for handling the enormous quantities of freight that are expected as soon as the route is thrown open to traffic on January 1, 1907.

The very end of the Congress was saddened by the death from typhoid fever on Sunday, October 14, of Dr. Franz Stradal of Vienna, Austria. Dr. Stradal was one of the younger members of the Congress, being only 27 years old, but he was a geologist of promise. He contracted the fever on the northern excursion, but he did not leave the party and go to the American Hospital in Mexico City until it was too late to save his life.

PHYSIOGRAPHY OF VIRGINIA.

BY

G. T. SURFACE, M.S.

The surface features are so closely connected with the geological history, and this in turn is so important in the determination of economic control, that we will discuss the physiographic phase from the view-point of geologic grouping and sequence. It is our purpose to give the reader a consistent portrayal of the Virginia land-mass at logical intervals during its physiographic evolution. The conclusions arrived at are based upon the most accurate information obtainable, in the absence of a complete topographic or physiographic survey of the State. As viewed from the standpoint of origin the land-mass divides itself into two major divisions: I. Appalachian Belt; and, II. Coastal Plain Belt.

Appalachian Belt.—The classification recognized under this division is somewhat arbitrary, but we believe it is entirely in harmony with the similarity and continuity of geographic control, which centred about the original Atlantic land-mass until towards the close of the Mesozoic era.

(A). *Archaean system* of the Archæan period.

(B). *Taconic system* of the Middle Silurian period.

(C). *Appalachian system* of the post-Carboniferous period.

(D). *Palisade system* of the Jurassic period.

A. *The Archaean System.*

This represents the older Appalachian belt, or the Appalachian *protaxis,* which extends in a narrow peninsular band from Canada to central Georgia. It is continuous through Virginia, and the present exposure varies in width from 10 to 40 miles. It is probable that the materials of the Taconic and Palisade systems were deposited in valleys and bays which had been carved out of the Archæan land-mass, or in synclinal troughs formed therein by elevation and depression. This would indicate that the area extended farther eastward at the close of the period. The enormous amount of material supplied for the formation of the Appalachian system adds evidence to the same conclusion. We can form no estimate of the height of the land-mass, but all of the conditions lead to the belief that it was thoroughly mountainous in type, and probably varied from 5,000 to 25,000 feet in elevation. Even with this estimate, we must suppose it to have been a region of elevation during a part of the Paleozoic era to account for the immense sedimentary deposits of the Appalachian system. The region suffered re-elevation during the elevation of the Appalachian system, as shown by the west-northwest overthrust of the crystalline beds on the lower Silurian beds, and the intense metamorphism to which the rocks have been subjected. Since the thrust force which produced the newer Appalachians was from the southwest, the effect on the Archæan area must have been to increase the area along the western border and to make the topography more precipitous along the western flank of what might be designated the Piedmont Chain. The Archæan area was of sufficient elevation in post-Paleozoic time to effectually cut off the new Appalachian region from an eastward drainage. The region varies in elevation from 300 to 1,200 feet, increasing in general as we progress westward. The drainage is entirely into the Atlantic, and has a uniformly southeast direction. The

Potomac, Rappahannock, York, James, and Roanoke Rivers are the most important streams. They are *transverse,* in that they flow at angles to the direction of strike of the intricately folded and foliated structure; and they are *antecedent,* in that their position was fixed prior to the rejuvenation of the old topography.

The *watersheds* between the drainage systems are indistinct, which is characteristic of a region which has reached advanced maturity.

The valleys are usually narrow but productive, and the intervening ridges vary in productivity according to the conditions of previous cultivation, the nature of the underlying rock, and the degree of decomposition. The percentage of iron present is greatest along the western border.

Large beds of iron ore occur in the Archæan series. The rocks consist chiefly of granites, gneisses, syenites, diorites, gabbros, and various schists, and cover most of the region known as the Piedmont Plateau, which extends from the *Fall Line* (where the rivers emerge from the harder rocks of the inland on to the Coastal Plain) to the slope and crest of the Blue Ridge. These crystalline and metamorphosed rocks are believed to represent a part of the original crust of the earth, and to have been first elevated by the unequal contraction of the outer cooling crust on the inner molten mass. Most of the rocks weather easily by the decomposition of the iron, alkalis and phosphates, which, when entirely removed, leave a light sterile micaceous or sandy soil. The percentage of these elements left largely determines the productivity of the residual soils, which makes a chemical study of them very necessary for the intelligent application of fertilizers.

The present Piedmont topography is that of a dissected plateau upland, the seaward remnant of a broad, gently rolling surface, which once extended westward beyond the Alleghany Front, northward along the Appalachians into New York and New England, and southward across the Cumberland Plateau of Tennessee to an unknown distance. This peneplain condition of the Jurassic period was first described and studied by Professor W. M. Davis in Pennsylvania and New Jersey, and was named by him the *Schooley Peneplain.** Professor Davis describes the Piedmont Plateau in its present dissected stage as illustrative of the peneplain. "It is a peneplain, not monotonously smooth, but undulating in graceful swells, between gentle depressions."—(Davis.) Mr. Willis, of the United States Geological Survey, in his physiographic study of the

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*Davis, W. M., "The Rivers of Northern New Jersey." National Geographic Magazine, 1890, vol. II., pp. 81–110.

Northern Appalachians, gave the name of Kittatinny Plain to this older base-level stage.*

B. *Taconic System.* (Middle Silurian.)

We will see under the discussion of the Appalachian System that at the beginning of the Paleozoic era there was being formed a great *geosyncline* along the western border of the Archæan land-mass. There was another geosyncline being formed at the same time along the eastern border. The indications are that there was a chain of these depressions, some of which were probably troughs of embayed synclinal valleys within the crystalline area. They were closely parallel to the Archæan *protaxis* and the Appalachian *geosyncline,* and extended from the region which marks the boundary between Canada, New England and New York, through Pennsylvania, Maryland and Virginia, and south-westward. These deposits thickened in the gradually sinking trough through the Cambrian and Ordovician periods, and at the close of the latter period were elevated into what has been called the *Taconic System.* The upturning resulted in great flexures and faults, and extreme metamorphism. The rocks present the same general characteristics as the Cambrian and Ordovician rocks of the Appalachian system, with the addition that the shales, sandstones and limestones are highly metamorphosed. The shales of Buckingham County have been definitely identified as belonging to theTrenton and Hudson epochs, and are a part of the Taconic series. The beautiful mottled brown and reddish brown marbles of east Tennessee belong to the same series (Hawkins and Knox counties). It continued a region of elevation, and therefore of denudation, through the Upper Silurian, Devonian, Carboniferous, Triassic and Jurassic periods, for no beds with marine fossils have been found over the area.

The series has suffered greatly from decomposition and erosion, which were facilitated by the crushing and disruption of the beds as caused by the violent crustal movements.

Great changes must have been wrought in the structure and surface features of the Taconic area by the forces which raised the Appalachian geosyncline into the towering *Appalachian Chain.*

The residual soils from the metamorphosed limestones are the most productive which occur in this belt. The shales and slates give rise to soils that are responsive to fertilizers and improved cultivation.

The streams cut across the strata as in the case of the crystalline series of the Archæan system.

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* Bailey Willis—Physiography of the United States, p. 189.

C. *Appalachian System.*

Throughout the long Paleozoic era the material for the construction of the Appalachian system was in process of formation, at the expense of the surrounding crystalline area. These sediments were deposited in a great geosynclinal trough, in which the rate of subsidence was so nearly equal to the rate of deposition that almost the entire thickness was accumulated in shallow water. At the close of the era the crustal movements began, through which the strata were elevated and compressed into a series of parallel, inclined or overturned folds, with an elevation of 20,000 to 40,000 feet. In some places the overturned folds pass into *overthrust* faults. One of these in the southern Appalachians of Virginia represents a dislocation of 5,000 to 10,000 feet, by which the Lower Silurian limestone is brought in juxtaposition with the Lower Carboniferous sandstone. This fault so weakened the strata through crushing and disruption as to invite maximum erosion and decomposition, resulting in the removal of all the strata above the Silurian. H. B. Rogers pointed out that the lines of faults in Virginia are continuous with the flexures in Pennsylvania. The faults may therefore be designated as *flexure faults.* The structure of the Appalachians closely resembles that of the Alps. The thrust force, however, in the case of the Alps was toward the ocean, while that of the Appalachians was from the ocean. The pressure, being greatest from the ocean side, gave rise to asymmetrical and inverted folds, and the mountain ranges decline into an elevated plateau on the landward side, with feebly undulating or horizontal stratification. This is exemplified in the West Virginia Highland and the Cumberland Plateau of Tennessee. This high mountain region was worn down to an undulating plain (Schooley or Kittatinny peneplain) during the Triassic and Jurassic periods, with surviving ridges here and there of more resistant structure.

Towards the close of the Jurassic period the region was subjected to a moderate and gradual re-elevation, attaining a maximum in Virginia of 1,400 feet (Willis). The arch-lines follow the general strike direction of the Appalachian folds. This period of elevation rejuvenated the streams on the uplifted plain, making the valleys deepest where the elevation was greatest, and most shallow where the uplift was least. A revolution of the drainage system was initiated over a part of the region in the denudation attack along the lines of induced weakness. The change was greatest over the Appalachian region proper, since most of the dynamical agencies work more effectively on sedimentary rock structure. The excavation of the valleys along the belts of weaker structure has resulted in a physiography more nearly approaching the mountain type than existed at the close of the re-elevation of the region. Most of the remnant ranges and the intervening valleys are the result of circum-denudation, the height of the ridges and the width of the valleys being the expression of the relative strength of the strata, and the amount of subsequent elevation. The *transverse* streams are contemporaneous with the larger *longitudinal* ones, but have only been able to carve out for themselves narrow valleys or precipitous gorges. From the standpoint of soil production they have added but little; but their economic value cannot be overestimated, since they have established natural locations for the great transportation routes across the Alleghany Mountains, and present ideal conditions for the most economic utilization of their superior water power.

The Appalachian *anticlinorium* has lost its physiographic identity, but it is readily revealed in a study of the structure as exposed by the stream dissection and surface denudation.

That part of the Appalachian System draining into the Atlantic Ocean is known as the Northern Appalachian, while the part south of New River, draining into the Gulf, is the Southern Appalachian.

The following subdivisions of the *system* are readily recognized in a topographic study: (1) Blue Ridge; (2) Valley; and (3) Appalachia.

(1) *Blue Ridge.* This stands out as the most prominent physical feature in the State. With an elevation of 1,460 feet at Harper's Ferry, where the Potomac breaks through the Blue Ridge, it increases southwestward, being 3,993 feet in Bedford County (Peaks of Otter), and reaches a maximum of 5,700 feet in Balsam Mountain, Grayson County, Virginia. This is a continuous barrier from the Maryland to the North Carolina boundaries, excepting four water-gaps and occasional wind-gaps. In its higher altitudes the crest line is marked by a hard, resistant sandstone of the Lower Cambrian period. The southern portion expands into a fan-like plateau, which is the watershed for the waters flowing into the Atlantic Ocean and the Gulf of Mexico. The counties of Floyd, Carrol, Grayson, Franklin, and a part of Montgomery are situated in the plateau portion. In North Carolina the plateau topography is intensified, and the elevation increases to a maximum of 7,000 feet.

The eastern flank of the Blue Ridge consists for the most part of highly metamorphosed Archæan rocks which formed the Paleozoic shore of the interior sea, and were thrust up by the great forces which gave birth to the Appalachian System. Along the crest, the western flank, and the western foot-hills, the Cambrian rocks predominate. Well-identified fossiliferous shales of the Lower and Middle Cambrian occur near Natural Bridge, and at Balcony Falls (James River gorge through the Blue Ridge at Balcony Falls). So far as developed for minerals, this is the most unproductive region in the State.

(2) *The Valley.* This is a continuation of the Great Valley of east Tennessee, and becomes the Cumberland Valley in Maryland and Pennsylvania, the Kittatinny Valley of New Jersey, and the Newburg part of the Hudson River Valley in New York. It is the central part of the *Greater Appalachian Valley,* as described by Willis, which includes the Blue Ridge, the Valley, and the Alleghany Ridges. The Valley region is that which lies between the western base of the Blue Ridge and the eastern base of the Alleghany Front. It is 15 to 30 miles in width, and 310 miles in length, making an area of about 5,000 square miles. It consists of the following minor valleys: The Shenandoah, 106 miles; James River, 50 miles; Roanoke River, 38 miles; New River, 54 miles; and Holston River, 52 miles. For the purposes of convenience we may recognize three general sections: The *northern,* or Shenandoah Valley section; the *central,* embracing that region between the headwaters of the Shenandoah and the Holston Rivers, which is cut by the transverse valleys of the James, Roanoke and New Rivers; and the *southern* section, that part drained by the Holston River.

Viewed topographically, it is a broad, gently rolling plain, with the floor dissected by minor drainage systems. The elevation increases south-westward and westward, being 242 feet above tide at the mouth of the Shenandoah, and 1,687 feet where the Holston River crosses the State line. The maximum elevation of 1,700 feet is reached in Wythe County. The Shenandoah Plain was carved out of the *Schooley Peneplain* during the Tertiary period, and the subsequent elevation and denudation have brought it to its present topographic condition.

The soil of the valley is prevailingly limestone, and it is by far the most productive of the natural divisions. George Washington* realized its great possibilities when he wrote: "In soil, climate and production, in my opinion, it will be considered, if it is not considered so already, as the Garden of America."

There is no marked decrease of fertility as we pass from the bottoms to the uplands. The bottoms are utilized intensively and extensively for cultivation, and the uplands for grazing.

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* Letter to Sir John Sinclair, 1796.

Settlements were made in the region as early as 1732. Several of the earlier ones were exterminated, but the natural conditions were so favourable that each depredation by the Indians inspired the settlers to stronger and more persistent resistance.

The position of the Valley topographically marks it out as a natural transportation route, so we find the Norfolk and Western Railroad traversing it from Bristol, which is on the Virginia-Tennessee line, to Roanoke; from this point the Shenandoah Valley extends to Harper's Ferry, on the Virginia-West Virginia-Maryland line.

(3) *Appalachia,* or *Alleghany Ridges.* This area embraces the region between the Valley and the Alleghany Front, which is the eastern border of the Alleghany Plateau, and is made of a series of ridges of northeast-southwest direction, alternating with narrow trough-like valleys. This general topography is interrupted where intersected by the transverse valleys, previously referred to. An examination of the ridges shows a remarkably accordant topography. They are believed to be the remnant of a plain of advanced topographic maturity formed during the Mesozoic era, which was continuous from Piedmont to the Alleghany Plateau, called by Davis the *Schooley Peneplain,* and by Willis the *Kittatinny Peneplain.* The region under discussion has been reduced to its present topographic condition since the Jurassic period by denudation and periods of elevation.

The ridges owe their elevation chiefly to the fact that the Carboniferous conglomerates and sandstones were depressed below the general level of the Kittatinny Peneplain, and thus escaped being worn away during the production of that feature. Subsequent elevation and denudation have removed the weakened anticlinal rocks, and left the synclinal remnants of hard sandstone standing out in relief, as protecting caps to the softer strata beneath.

Like the land of the Valley, the Blue Ridge and the Alleghany Front, these ridges increase in general elevation southward. Many of them exceed 3,000 feet. Elliot's Knob, 20 miles west of Staunton, has an elevation of 4,473 feet.

The Appalachia and Valley topography of southwest Virginia has been materially influenced by a series of faults which produced a displacement of 500 to 12,000 feet. The most important we may designate the *Saltville* or *North Holston* fault, with a maximum displacement of 10,000 feet; the *Walker Mountain* fault, with a maximum displacement of about 10,000 feet, and seemingly continuous with the *Great Fault* of Northern Virginia; and *Draper Mountain* fault, which by a maximum displacement of 12,500 feet brings up the Lower Silurian in Wythe and Pulaski County as a rugged mountain in the heart of the Valley. Two cross-faults pass from it, the *Max Meadows* in a westward direction, and the *Pulaski* in a northwestern direction, toward the Walker Mountain fault; so that in the very heart of the Valley there is a block of Upper Silurian, Devonian and Lower Carboniferous, with Lower Silurian on two sides, Cambrian on the third, and Lower Carboniferous on the fourth.*

The soils of the upper slopes are usually sandy and sterile, being derived from the heavy siliceous sandstones and conglomerates. Beneath these strata occur the softer shales, some of which (the most calcareous) form fairly productive soils. The residual soils from limestone are always fertile, but most of the limestone strata have been removed by denudation.

Because of the very broken topography common to the region, it is best adapted to grazing. The narrow valleys are made up of sandy calcareous alluvium, with often a strong impregnation of iron, and are productive. Cultivation is concentrated on the valleys and lowlands.

More virgin forest survives in this belt than in any other part of the State, because of its inaccessibility. With the superior water power, which abounds throughout the region, the manufacture of hardwood products should become an important industry.

This is the most productive region of the State in mineral resources.

The bold south-eastward-facing escarpment of the Alleghany Plateau border constitutes the western border of the Alleghany trough. The State line is approximately marked by it, except in the southwest corner.

From Little High Knob (26 miles south of the Potomac in the Virginia-West Virginia boundary) southwestward it declines in elevation.

New River, flowing north-westward, enters the plateau in a cañon 1,500 feet deep. All the other streams crossing the Front rise in the plateau and flow southwestward, to emerge from deep cañons into the minor valleys of the Great Valley. This peculiar drainage adjustment was brought about by a southeastward tilting of the northern part of the plateau in the elevation subsequent to the Schooley Peneplain stage, while south of the New River divide the tilting was to the southwest.†

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* American Journal of Science, 1887, p. 262.

† Russell, I. C., Rivers of North America, p. 205.

D. *Palisade System.* (Jurassic Period.)

At the beginning of the Triassic period it is probable that the Virginia land area extended farther east than it does at this time. During this period a series of narrow troughs was formed along the Atlantic slope, closely parallel to the trend of the Appalachians, as if occupying orographic valleys in the chain; but separated from them by the remnant ridges, which were still sufficiently high to effectually cut off the Appalachian drainage from the east. The depressions could not have been formed from an oceanic submergence, for no marine fossils have been found in the beds; neither could they have resulted from stream action alone, or the nature of the rock structure would be different. The most probable supposition, therefore, is that the depressions represent the topography of the continental border after the Appalachian upturning. The water accumulated in these depressions in estuaries, fresh-water lakes, streams, bogs and swamps, and the depositions took place slowly and to great depth. The rocks are mostly granitic sandstones, sandy shales, conglomerates, bituminous coal, along with carbonaceous shales. The extent of the conglomerate formation and the prevalence of the cross-bedded structure give evidence of the presence of strong currents.

The longest trough seems to have been continuous from the Hudson River south through New Jersey and Maryland, and into Virginia as far as Cumberland County, a distance of 350 miles. It is probable that the Richmond area was a separate basin, 35 miles in length; and that the Pittsylvania area belongs to the Dan River trough of North Carolina, 100 miles in length (40 miles in North Carolina). The thickness of the beds in Virginia varies from 2,000 to 3,000 feet.

Productive coal beds occur in the Richmond* basin south of the Chickahominy River, being northwest of the city of Richmond, and separated from the northern part of the Richmond Mesozoic area by an interval of crystalline rocks about 3 miles in width. This is the only Mesozoic area in Virginia which retains the basin form in its present structural condition.

The lateral pressure whch caused the elevation of the series was chiefly from the west, while that for the Appalachian system was chiefly from the east. The elevation took place at the close of the Triassic or in the early Jurassic period. Faults are frequent, and volcanic action became general, as shown by the numerous dykes which cut the series.

The crustal movements, however, over most of the region resulted in monoclinal uplifts of low angle. Flexures are rare and local, the largest being that of the Richmond Basin.

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*U. S. G. S. Bull. No. 85, 1892; American Journal of Science, 1879.

The Jurassic period was one of great denudation, when the high ranges of the Appalachians were much wasted away, and the newly-elevated Triassic beds were deeply eroded.

The brown sandstone of this series supplies one of our most valuable building stones.

COASTAL PLAIN.—At the close of the Jurassic period there was a slight elevation; but this was of short duration, and gave place to a strong eastward tilting of the land, which permitted the western transgression of the Upper Potomac formation.* The Potomac series was formerly classified as Lower Cretaceous by Davis† and others, but the very careful stratigraphic work of the Maryland Geological Survey has led to the classification of the lower beds of the series to the Jurassic. The Coastal Plain Series begins with the Potomac Group‡, which were formed in a narrow band along the Atlantic Coast. Detached portions of the beds indicate that they formerly extended farther westward. The different members of the Coastal Plain series were formed by alternate periods of elevation and depression. It is beyond the province of this discussion to enter into a detailed description of the geological history.

The series consists of sands, clays, loams and gravels, usually in the unconsolidated state, and arranged almost horizontally.

The Tertiary period was inaugurated by an encroachment of the sea, and the Eocene deposits of sands and clays formed in a narrow band through New Jersey, Maryland and Virginia. From Virginia southward the deposits become much broader. The crustal movements which closed the period were greater from south to north and from east to west, giving a southeast tilting. This is true for the whole Coastal Plain series, as evidenced by the thickness of the beds, and the resulting topography. One of the salient topographic evidences is the increase in the southeastward deflection of the streams along the western border of the Coastal Plain (along the "Fall Line").

The early Miocene witnessed a slight transgression of the sea, as a result of which the Upper Miocene beds were deposited on the Lower Eocene. By the close of the period the Atlantic and Gulf shores had attained almost their present outline.

A broad belt, extending from the Piedmont margin to the centre of the Coastal Plain, is covered by a mantle of Lafayette (Pliocene) deposits in the interstream area. These consist of clay, loam, sand and gravel, the latter being often ferruginous and cemented into a compact ironstone. The formation has an average thickness of about 50 feet.

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* Physiography of Maryland, Part II., p. 144.

† The Geological Dates of Origin of Certain Topographic Forms. Geol. Society America, Bull. II, 1890, pp. 545–548.

‡ Physiography of Maryland, II, p. 121.

With the close of the Tertiary the Atlantic Coast was raised about 100 feet in the Virginia portion. On passing from Piedmont to the Coastal Plain, the stream character changes abruptly from rapids, falls, and steep gorges, to meandering streams over a terrace-bound lowland. The terraces were formed by the flood-plain condition existing during the Pleistocene period.

The great number of bays and estuaries are of comparatively recent origin, having been formed by the gradual subsidence of the Coastal Plain region, by which the rivers were drowned in their lower course through the transgression of the ocean. The Susquehanna River formerly entered the ocean east of Cape Henry, and the Potomac, James, York and Rappahannock were its important tributaries. The continued depression converted the lower Susquehanna Valley into the Chesapeake Bay, and embayed the mouths of the lower tributaries, making them tidal streams. Accomac and Northampton Counties became thereby separated from the mainland.

The effect was to make all of the important streams navigable in the Coastal Plain part of their course, and it gave to the State in the formation of Hampton Roads (estuary at the mouth of the James River) the finest American harbour.

The elevation increases from sea-level to 150 feet on the western border. From the surface configuration the land is commonly designated as *first* and *second bottom,* and the *ridge country.* The *first bottom,* where protected from the tide, is very productive. It is in this portion that most of the swamp and marsh lands occur, all of which are covered with a variety of swamp and marsh grasses, which are partially utilized for grazing. Wherever this has been reclaimed it is exceedingly productive, Dismal Swamp* being the most notable example. No survey or special study has been made of these wild lands, but there is no doubt but that hundreds of square miles could be reclaimed at a cost which would leave a wide margin of profit.

The *second bottom* is alluvial, as the *first,* and is the most valuable part of Tidewater. The subsoil is a dark red or yellow clay, with a moderate admixture of sand. The surface soils consist of sandy loams, which vary in colour and consistency according to the mineral and vegetable matter predominating. The *ridge country* has an elevation of 90 to 150 feet above sea-level. The soil is a light sand, easily eroded, and intractable to most methods of improvement. This section represents one of the most important economic problems in the State. Calcareous marls have proved very beneficial, and it is believed by some fertilizer authorities that most of the area can be brought into a state of at least fair productivity.

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*Dismal Swamp marks the southern limit of the bog mosses (Sphagnei) which are common further north, and the northern limit of the dwarf palmetto.

Emory and Henry College, Emory,
Virginia.

DR. ROLLIN A. HARRIS' THEORY OF THE TIDES.*

BY

G. W. LITTLEHALES.

In a manner characteristic of a master of the facts of observation in relation to the tides and as the author of forms of computation for the analysis and classification of tidal records which constitute the greatest advance in practical tidal work since the introduction of the harmonic analysis, Dr. Harris has addressed himself to the task of outlining a tidal theory which shall account for the tides as they are actually observed to exist in nature. His preliminary studies of the causes of the tides led him to attempt to mark out in the oceans and other bodies of water such areas, or systems of areas, as are capable of independent oscillation in the same or nearly the same period as the tidal forces have, and in which it is possible for the tidal forces to cause the tide to mount up to a considerable amplitude; and then to obtain theoretical results with reference to these areas, under the supposition that the tidal forces are distributed over the waters of each system and that the times of elongation of the water particles are thus determined with reference to the tidal body. Having compared these theoretical results with the observed values, he announced that in most cases the dominant ocean tides have their origin in definite systems whose free periods of oscillation are very nearly those of the tidal forces, and that the time of high or low water in each is the time when the virtual work of the tidal forces upon the system becomes zero.

For the semi-diurnal tides, the systems pointed out are seven in number, comprising the North Atlantic, South Atlantic, North Pacific, South Pacific, North Indian, South Indian, and South Australian. For the diurnal tides there are fewer systems. A system may comprise several regions of comparatively simple form, styled oscillating areas. If these areas could be partitioned off, each would have its free period of oscillation approximately equal to the period of the tidal body. From the tides thus produced are derived both stationary and progressive waves.

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* Manual of Tides. Part IV A: Appendix No. 7—Report for 1900; Part IV B: Appendix No. 5—Report for 1904. } Coast and Geodetic Survey, Washington.

This is the keystone of the arch upon which is built the new explanation of the tides as they are found to exist in reality, and it is doubtless a doctrine that will prove to be of permanent value as an agency for advancing to a complete treatment of the actual causes of the tides. Philosophers have held that the tides of the ocean advance westward, tending to follow the moon in its apparent diurnal course in the heavens; and, according to this teaching, a westerly progression would be especially looked for in the southern seas where a continuous zone of water encircles the earth. But, as a matter of fact, there is a remarkable eastward progression in the South Pacific Ocean, and, as an illustration of the rational bearing of the author's theory, it may be said that this eastward movement is directly traceable to the boundary conditions surrounding the South Pacific oscillating system.

It is probable that the author was brought to recognition of the necessity for the existence of oscillatory motion sustained by the tidal forces by realizing the smallness of the effect of the forces demanded by the equilibrium theory in comparison with the ocean tides as they are known to be, and thus seeing that tides as great as the actual ones could only be produced by successive actions of the tidal forces upon systems, of such a nature that they would preserve the general character of their motion during several successive periods of the tidal body if the forces of attraction were to cease their action.

Of tides occurring in natural bodies of water, those most easily understood occur in bodies so small and deep that the equilibrium theory applies. To such cases Chapter I, Part IVA, is directly applicable, as are certain sections in previous parts of the Manual, notably §§38-40, 42, Part I, and §§49, 50, Part II. For instance, we see (§3, Part IVA) that for a body of water not too shallow, lying under the equator and extending 172 sea miles east-and-west, the amplitude of the mean lunar tide at either end would be 0.08 foot; high water at the east end would be simultaneous with low water at the west end, and *vice versa*. The central meridian would constitute a nodal line along which there would be no rise and fall. For such a body of water situated in any other latitude, the rise and fall at each end would diminish as the cosine of the latitude, while there would be some rise and fall on the south and north shores of the body. And so for any latitude north or south of the equator, a lake-like body will not possess a nodal line but a no-tide point. This point is the centre of gravity of the surface, and from it the cotidal line must radiate as straight lines.

The force diagrams, Fig. 1, Part IVA, furnish a ready means of computing the amplitude and time of tide for any small body of water whose depth is sufficiently great for causing its free period of oscillation to be but a small fraction of the period of the semi-daily or daily tidal forces. The equilibrium theory applies reasonably well to such bodies of water as Lake Superior, and the eastern portion of the Mediterranean Sea. On account of the expanse of the oceans, the water surface cannot arrange itself normal to the tidal forces in the period of a half day or a day, and so cannot obey the equilibrium theory. It is desirable, however, to have means of ascertaining the theoretical amplitude of the tide and the cotidal lines for bodies less extended than oceans, yet so large that the curvature of the earth's surface cannot be ignored; and §4, Part IVA, shows how such cases can be treated.

Chapter III, Part IVA, is devoted to a discussion of free oscillations in bodies having various geometrical forms. It illustrates the contour lines, including the nodal lines, and lines of motion, and shows how depth, horizontal dimensions, and period are related. The modes of oscillation obtained for a few simple areas have a much wider application than is at first evident; for if a thin, vertical wall be put in the place of any line of motion, the character of the motion will not be affected; and so a great variety of forms can be readily discussed. Chapter V supplements Chapter III, by experiments upon small bodies of water.

Chapter VI treats of small oscillations sustained by periodic forces, and has special reference to the prevailing ocean tides. The smallness of the equilibrium effect of the direct action of the tidal forces, if applicable to the oceans, can be inferred from the value already given for small bodies; which amounts to saying that the slope upon which the surface of the water temporarily lies when the maximum disturbing forces are acting in equatorial regions is, for the mean moon, only 0.017 of a second, or one vertical unit to about 12 million horizontal units. The equilibrium amplitude of tide for a deep body 1,720 sea miles long would not be ten times as great as the amplitude for a body 172 miles long, but something less, even if the body were entirely enclosed by land. With the imperfect boundaries, and the prevailing ocean depths, it is evident that equilibrium tides must be small. The observed magnitude of the tide shows the necessity of oscillatory motion sustained by the tidal forces; and so the effect of a number of successive impulses is represented in any particular tide. For simplicity, canal-like areas are chiefly, but not exclusively considered. The body of water is supposed to be given in position, as upon a chart, and the forces, or local force arrows, of the diagram, Fig. 1, are readily found for any assumed Greenwich component hour. These are supposed to be properly scattered over the oscillating body and the times of elongation of the particles, *i. e.*, the times of high or low water at that loop, thereby determined.

Chapter VII consists of applications of the theory to the tides. In addition to the theory already developed numerous lemmas are laid down, which the conditions of the natural bodies of water require. Here the fundamental systems, shown in the world-charts designated as Figure 23 and 24, accounting for the dominant tides in nature, are pointed out and briefly described. Evidence of nodes and loops, or approximations to these, is also cited. In laying down these oscillating areas, certain requirements have to be filled at least approximately, *e. g.*, the free period as calculated by the body's horizontal dimensions and depth must approximate quite closely to the period of the tidal forces; if rectangular, the areas must be a considerable portion of a wave-length in width, and the more defective the lateral boundaries the broader must be the rectangle, in order that the forces may produce sensible tides.

Chapter VIII deals with tides in rivers, straits, bays, etc., its object being to explain some of the more local features of the tides.

Part IVB of the work is chiefly devoted to the descriptive and cartographic representation of the cotidal lines of the world, deduced in conformity with the theoretical considerations which have been unfolded as a means of obtaining a first approximation to the times of the principal ocean tides, and justified by the use of richer and more varied observations and a wider knowledge than have ever before been brought to bear upon this subject. The charts of cotidal lines are thirty-six in number, and relate to all parts of the seas of the world. The lines have reference to the *mean luni-tidal interval* and not the interval at *full and change* of the moon nor to the *M2 interval,* and the ranges given are *mean* or *average ranges* and not ranges at spring tides.

Upon referring to the world-chart of cotidal lines, it may be noticed that there are several points situated in different parts of the world around which the tidal hours are represented to progress, completing a cycle of values in the period of the tidal oscillation. These are no-tide points, or places where the range of tide is nothing; and the regions in which they occur are called amphidromic, on account of the radiating cotidal lines having a cycle of values. They are caused by the overlapping of systems, by progressions due to secondary or dependent bodies of water into which a free wave progresses, and by the necessity for a gradual change between adjacent regions whose tides are not simultaneous; and they constitute a characteristic innovation in this great work, among whose chief fruits must be the benefits that will come from pointing out before the world, in a manner so orderly, the avenues of investigation and observation along which the further advancement of our knowledge of the tides is to be approached.

Nov. 23, 1906.

GEOGRAPHICAL RECORD.

AFRICA.

A Letter on African Languages.

Editor Bulletin:

Sir: The importance of language in relation to political and social aspects of the native question in Africa seems liable to be overlooked. The possibility of large groups of tribes, hitherto distinct and mutually antagonistic, becoming rapidly able and eager to understand each other in some common form of speech has apparently to be taken into account. Twenty-six years' contact with Swahili and various dialects of Eastern and Central Africa points so far to the conclusion that there is a remarkable degree of similarity, amounting in many important respects to substantial identity, in the grammatical structure of language over the whole vast area occupied by the Bantu races of Africa, from the Soudan to the Cape. And the stock of words common to all Bantu tribes, when recognised under their various dialectic disguises, will probably prove very considerable.

The Officials, Missionaries, Traders, Settlers and Travellers of various nationalities who are qualified to give help in testing this conclusion by personal and first-hand study of a Bantu dialect are naturally difficult to reach,—scattered in remote and often isolated spheres of work. It is, therefore, perhaps justifiable to ask publicity for the request, that persons so qualified and willing to accept and reply to a brief communication on the subject would send me their addresses at Fort Jameson, North Eastern Rhodesia. I should be grateful if foreign journals and local papers in Africa, general and official, would assist by calling attention to my invitation.

I am, etc.,

(sgd) A. C. MADAN,
(Student of Christ Church, Oxford.)

c/o The British South Africa Company,
FORT JAMESON,
NORTH EASTERN RHODESIA.

12th July, 1906.

A STUDY OF THE SEBU RIVER, MOROCCO.—In the last month of 1905, Lieut. Dyé of the French Navy, commanding the hydrographic mission to Morocco, and E. Pobeguin made a survey of the middle course of the Sebu River, taking soundings, studying the *régime,* and also the life of the people along its shores and the products of the fertile plain. Mr. Pobeguin has a paper on the river in *La Géographie* (No. 4, 1906). The Sebu rises somewhere in the Atlas ranges, flows past Fez, and empties into the Atlantic. Though many travellers had seen the river, our knowledge of it was meagre, for only a few intrepid men—Tissot, Fischer, and Capt. Larras—dared to attempt any surveys in the valley.

The writer says that the Sebu is without doubt the most important river of northwestern Africa. Watered by rains in winter and by melting snows in summer, its discharge is quite regular in quantity. It flows in numerous meanders over an alluvial plain which is an ocean of verdure. In the distance are snow-covered mountains. No marked depression of the surface indicates the river from a distance, but its position is shown by the line of fig trees growing on the banks. The trench in which the river flows is bordered by banks of fertile alluvium from twenty to forty feet in height. The river, unseen till the traveller stands on its edge, is in one place rapid and with many sharp bends, and in another it widens, and the lower course is gentle and comparatively straight.

The Beni Hassen, who live along the muddy banks of the left shore, have a bad reputation, which they seem to deserve. Many of them have been driven across the river by their southern neighbours, the Zemmurs, and the fugitives have driven the peaceful farmers along the right bank from the fields. The continual difficulties between the frontier tribes and the fact that both banks are infested with brigands make the journey anything but agreeable. The tribes are always fighting one another. They are armed with rifles, and their principal means of living is the theft of each other's cattle. The Christian traveller is, of course, regarded as a tempting victim. The French explorers often found it necessary to open their baggage in order to convince the people that the boxes were not full of money.

The natives were much disturbed by the efforts to take soundings, and even more by the work of triangulation. The explorers were finally compelled to give up canoeing on the river. In spite of the fertility of the country, it may be many years before we shall see the Sebu except at Mechra el Kçiri, the ford on the route from Larache to Fez, or perhaps at Hadjer el Ouâqenf, the ford on the route from Tangier to Fez.

WORK OF THE SURVEY DEPARTMENT OF EGYPT.—In his *Report* on this work in 1905 (Cairo, 1906), Capt. H. G. Lyons, Director General, says that the chain of triangulation from the Mediterranean along the Damietta branch of the Nile and up the Nile Valley as far as Wadi Halfa is completed. From Cairo southward this forms a network, covering all the cultivated land; while to the north about two-thirds of the delta have not yet been triangulated with sufficient accuracy, but this work is now in hand. With the completion of the triangulation in Upper Egypt the cadastral survey progressed rapidly, and a very large out-turn for the year brought within sight the completion of the mapping of the cultivated lands of Egypt for revenue purposes. With the completion of Beni Suef province in the latter half of 1906, the whole of the cultivated land of Egypt will have been surveyed on the scale of 1:4,000 or 1:2,500 and the maps of all excepting the provinces of Sharqia, Beheira and Beni Suef will have been printed and published.

FLOODS IN THE CONGO BASIN.—Mr. Leo Frobenius, in his fourth paper on his travels in the Kassai basin (*Zeitsch.* of the Berlin Geographical Society, No. 7, 1906) says that the rainfall was extraordinarily heavy in the upper part of the Congo basin early in 1906. No European there had ever before seen such a rise in the waters of many of the tributaries. Villages were overwhelmed, and a great part of the riverine life was transformed into lagoon life. The natives built platforms in their huts or near them, on which they took refuge, and boats were the means of communication between the settlements.

PERMIAN GLACIATION IN SOUTH AFRICA.—Professor W. M. Davis has recently published a full statement of his physiographic observations made during attendance upon the recent British Association Meeting in South Africa.* This paper contains much interesting description of that region and comparison of the conditions there with those in North America. A part of the paper is devoted to a statement of the remarkably clear evidence of Permian glaciation, closing with a discussion of the possible causes for this glaciation. These glacial conditions were not those of local valley glaciers, but of the continental type, and the deposits are spread over an area just outside of the Torrid Zone, the source of the ice being from the north—that is, from a region nearer the equator. Professor Davis points out that there is good evidence that this region was not one of great altitude at the time, and that under present conditions of latitude and distribution of wind systems it is exceedingly difficult to account for this phenomenon of glaciation. He shows that changes of land area or land form appear ineffectual as an explanation of glacial conditions here, and that "No conceivable arrangement of continents and ocean currents could produce an abundant snowfall in latitude 25 degrees, so long as the general temperature of the atmosphere preserved its present values."

An interesting part of Professor Davis' discussion is the inclusion of a serious consideration of a possibility of an actual shifting of the poles. He states that "If a change in the position of the axis took place in Permian time, it would seem easy thus to account not only for the Dwyka glacial formation of South Africa, but also for the Talchir glacial formation of northwestern India, and for the Muree glacial formation of southeastern Australia." He further brings forward the evidence against shifting of the poles and concludes in the following words: "The shifting of the poles is therefore at present not only a daring hypothesis, but gratuitous and discredited as well. Nevertheless, if evidence of Permian warm climate were found around a zone that would be equatorial to an Indian Ocean polar area, and if another Permian glacial area were found in the regions antipodal to the Indian Ocean, this daring, gratuitous, and discredited hypothesis would have to be taken seriously into account.

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* Bulletin of Geol. Soc. of America, Vol. 17, 1906, pp. 377-450.

"The cause of the Dwyka glaciation for the present remains a puzzle, although the effect of the glaciation is well established."

It is true, also, that the cause of the Pleistocene glaciation is, though a fact, a puzzle. It is likewise true that a change of the poles would account for the phenomena observed. Geologists generally have been rather chary of even entertaining this hypothesis—first because there is no known cause for such a change, and, second, because there is no evidence of the disturbance in the crust, which it is believed would necessarily follow such a change, by the adjustment of the equatorial bulge to a shifting axis. It requires such a remarkable phenomenon as continental glaciation in a subtropical region to lead to a serious consideration of the possibility of a change in the earth's axis, and there are many who, though this hypothesis is "daring, gratuitous, and discredited," will be inclined to give it serious consideration. R. S. T.

GOLD IN THE TRANSVAAL IN 1905.—Since the resumption of mining operations at the end of the war between Great Britain and the Boers in 1901, the value of the annual product has steadily increased until the gold output of the Transvaal again surpasses that of any other region. According to the *Report* of the Government Mining Engineer (Transvaal Mines Department), the gold yield in 1905 was worth $104,272,200. Mining was resumed in May, 1901, and the total yield of gold from that time till the end of last year was $289,550,500. During the second half of 1905, the yield per ton of ore crushed, not including gold contained in by-products not treated at the mines, was 34.91 shillings a ton. Including the gold estimated to be contained in products sold the total yield per ton crushed was 35.19 shillings. At the end of last year the labourers employed in gold production inincluded 18,159 whites, 93,831 negroes, and 47,267 Chinese.

CONDENSATION FROM CLOUDS ON TABLE MOUNTAIN.—Observations have been made on Table Mountain, South Africa, in order to ascertain the amount of water due to the deposit of moisture from southeast clouds on the surface of vegetation as distinguished from the actual rainfall. Gauges screened by reeds were employed, and showed that the amount of water which reached the gauges during long periods of southeast clouds was far in excess of the total rainfall for the corresponding period. The gauge with reeds collects more water than an ordinary gauge during any ordinary rain; but the most marked difference occurs during misty rain, showing that the vegetation is effective in capturing moisture apart from the real rain.—(*Geogr. Journ.*, XXIV, 96; *Trans. So. Afr. Phil. Soc.*, XVI, 1905, pt. II.) R. DEC. W.

AMERICA.

ANNUAL REPORT OF THE NEW JERSEY GEOLOGICAL SURVEY FOR 1905.—Mr. Kümmel reports that the sales of maps to the public showed a marked increase in 1905, particularly in the case of the large-scale sheets, the increase being nearly fifty per cent. This increase has been made in spite of the competition of the U. S. Geological Survey, whose maps are much cheaper than those of the State Survey. The Survey used considerable mineralogical and geological material during the year in making thirty collections of 170 specimens each of rocks, minerals, fossils, and ores for distribution to the high schools of the State.

Among the papers is one by Prof. Lewis M. Haupt on recent changes along the New Jersey coast, in which he records several instances where remedial works, constructed at great expense, have utterly failed to accomplish the desired end because of improper design or location. He also presents good evidence to show that by properly-constructed jetties, so shaped and placed as to guide the currents in desired directions, the action of tidal scour may be made effective to remove bars and keep channels open.

Mr. C. C. Vermeule discusses at length the project of transforming the low, flat country along the Passaic River above Little Falls and as far as Chatham into a lake and reservoir, for the prevention of floods in that river. The survey has been procuring data for definite answers to the questions involved. Thus far, the most desirable flow-line is indicated at an elevation of about 190 feet, which would make the area of the proposed lake 33,536 acres.

SALT INDUSTRY IN OHIO.—A recent publication of the Geological Survey of Ohio (4th Ser. Bull. 8, by Prof. J. A. Bownocker) furnishes material for an excellent illustration of the influence of the distribution and development of natural resources upon the distribution of industries.

In the pioneer days of Ohio, salt springs in southeastern and eastern Ohio were the only sources of salt in the State. These wells were not rich in salt, but flourished (1) because of the local imperative demand for the product—a demand which could not because of distance and difficulty of travel be well supplied from New York; (2) because of the cheapness and abundance of local native fuel in the adjacent forests and coal seams; (3) and, rarely, because of the recovery of valuable by-products, as bromine and calcium chloride, the latter for land-dressing.

Some salt works prospered above others (1) because of market advantage, usually in near-by towns (notably true of the Morgan County works, which shipped by river to Zanesville), (2) because of greater richness of brine, and (3) because of cheaper fuel. Many passed into disuse when the brine became weaker, when fuel became exhausted, or when competition arose with wells having saturated brine. Six plants still continue; five in and near Pomeroy persist because of the cheapness of fuel (coal dug from the foot of the hills near-by), and one at Durant, because of a large near market at Zanesville, and in spite of some difficulty in getting coal. In the case of the five plants the saving of the by-products helps to make the business profitable.

Competition came from the rapid expansion of the industry in Michigan and in New York, and later in northeastern Ohio. The latter began in 1889, on the discovery of saturated brines at Newburg, and later at Cleveland, Kenmore, Wadsworth, and Rittman. The plants at these localities are shown to have geographic advantages, as follows, which seem to insure their continued prosperity: (1) While fuel is not as cheap as in southeastern Ohio, coal, either local or near, provides plenty of fuel at reasonable cost; (2) The salt is very abundant, accessible, and is obtained in almost or quite saturated brines; (3) markets in the cities and all through this more densely-populated region are excellent; (4) transportation facilities to distant points are excellent; (5) dependent industries have sprung up near the salt plants. Fertilizer-making, glazing, soda, and soap-making are among the consumers of the products of the salt industry.

Thus while the early industry could only supply local needs, the extensive development of the richer deposits in the northeast has practically crushed out the weaker industry in the southeast, and has brought to its side several industries which use its products and in turn stimulate the development of the fundamental industry.

G. D. H.

GOOD ROADS IN INDIANA.—Most of the *Annual Report* for 1905 of the Department of Geology and Natural Resources of Indiana is devoted to the question of good roads. In 1902, the Department began to study the location and quality of road-material deposits in each county of the State. The present Report, containing the result of this investigation, shows that Indiana is abundantly supplied with road materials, and that they are well distributed, as only eight or ten counties will have to import gravel or stone. In the northwest corner of the State both gravel and stone are lacking or are deeply buried under the drift. In the southwest corner and the greater part of Pike, Posey, Vanderburg, and Warrick counties, the drift-line is to the north and the sub-carboniferous limestones are to the east, so that they lack both gravel and stone suitable for road use.

It is unfortunate that the excellent reports of this Department are illustrated by so many maps of poor quality. Many of the maps in the *Report* for 1905 are inferior to the average newspaper map.

AREAS IN THE UNITED STATES.—The question, "What constitutes the area of the United States?" is discussed in Bulletin 302 of the United States Geological Survey, written by Mr. Henry Gannett. Jurisdiction extends to a line 3 nautical miles from the shore, but this strip of sea cannot properly be regarded as a part of the country. Supposing our country to be restricted to the sea and lake coast, there remains a question regarding the bays and estuaries. To what extent should the coast-line be followed strictly, and where should we begin to jump across the indentations made by the sea? In this matter one can only follow his own judgment, making in each case as natural a decision as possible, as no definite criterion can be established. The absence of an absolute standard is in large measure the cause of the discrepancy between the tables of the Census Office, made in 1881, and those of the General Land Office, prepared in 1899, both of which show the areas of the United States and of the several States and Territories.

The measurements and computations upon which these tables were based were made with great care and thoroughness in each case, and the results probably represented the areas as closely as they could be determined from the maps and charts in existence at the time. Most of the differences in these two sets of tables are trifling, amounting to only a few square miles or a small fraction of 1 per cent., being well within the limits of error of the planimeter and of the maps used. Some of them, however, are considerable, and a few are explained by the fact that more recent maps, which changed the position of boundaries between States, had been used by the Land Office, and its measurement was, therefore, more nearly correct. Other discrepancies arose from differences in determining the coast-lines.

Realizing the desirability of but one Government statement of areas of the States and Territories, an attempt has been made by Mr. Frank Bond, chief draftsman of the General Land Office, Mr. C. S. Sloane, geographer of the Census Office, and Mr. Henry Gannett, geographer of the Geological Survey, to come to an agreement on these figures. The results of their conference and co-operation are set forth in the aforementioned bulletin.

By this adjustment the area of the United States proper, which is given as 3,026,789 square miles, is increased over the Census Office figures by 1,188 square miles.

The area given for Alaska is 590,884 square miles. It is subject to considerable modification in the future as the position of the coast-line becomes better known. The area given for the Philippine Islands is 115,026 square miles, and was determined by the Coast Survey of that archipelago, prepared at the instance of the Philippine Census. It is also subject to modification by accurate charts of the archipelago. The areas of Hawaii, 6,449 square miles, and Porto Rico, 3,435 square miles, are probably subject to only slight changes, as the charts from which they were measured are quite accurate. The areas given for the other small possessions of the United States—Guam, 210 square miles, Samoa, 77 square miles, and the Panama Canal strip, 474 square miles—will probably be changed in the future as their limits become more correctly defined.

PRODUCTION OF COAL IN 1905.—Mr. Edward W. Parker, statistician of the U. S. Geological Survey, reports that the production of coal in this country in 1905 reached 392,919,341 short tons, valued, at the mines, at $476,756,963. Both in quantity and value these figures surpass all our previous records. Of the total production 77,659,850 short tons were Pennsylvania anthracite, valued, at the mines, at $141,879,000. The total production of bituminous coal and lignite was 315,259,491 short tons, valued at $334,877,963. The total production of this country last year was nearly 50 per cent. larger than that of Great Britain, which, until 1899, was the leading coal-producing country of the world. The total increase in the production of coal in the United States in 1905 over 1904 was larger than the production of France in 1904 or of any other foreign country excepting Great Britain, Germany, and Austria-Hungary, and was almost equal to the production of Austria-Hungary. Since the United States began to mine coal, the output has been practically doubled in each decade.

STATISTICS OF U. S. RAILWAYS FOR THE YEAR ENDING JUNE 30, 1905.—The annual report of the Interstate Commerce Commission for this period shows that the total single-track railroad mileage in this country was 218,101 miles, or 4,196 miles more than at the end of the previous year. The aggregate length of railroad mileage, including tracks of all kinds, was 306,796 miles. The railway equipment included 48,357 locomotives, and 1,842,871 cars of all classes (passenger service, 40,713 cars; freight service, 1,731,409; and company's service, 70,749 cars). The number of persons on the pay rolls was 1,382,196, which is equivalent to an average of 637 employees per 100 miles of line. The number of passengers carried was 738,834,667, and the number of tons of freight carried was 1,427,731,905.

GEOGRAPHIC DICTIONARY OF ALASKA.—The second edition of this useful work has been issued as *Bulletin* 299 of the U. S. Geological Survey. The first edition, which appeared in 1902, contained about 6,300 names and 2,800 cross references; the present volume has about 9,300 names and 3,300 cross references. This large increase in the nomenclature is striking testimony to the rapid growth of the Territory in industrial importance. Many of the names are those of new mining towns, camps and mineral fields; many others have been obtained by explorers and surveyors while carrying out fresh geographical work, and others have come from the native tribes or from old settlers, miners, prospectors, pilots and fishermen.

The plan of the dictionary is to give alphabetically all the published names which have been applied to geographical features in Alaska. This includes obsolete as well as current names. It aims to show the origin, history, modes of spelling, and application of each name, and in the cases of Indian, Eskimo, and foreign names their meaning also. And finally it shows, in bold-face type, the forms approved by the United States Geographic Board. Rejected, doubtful, and obsolete forms are printed in italic. Elevations are given when known. The work is brought down to about 1905. One of the most interesting features of the bulletin is a list of the principal authorities used in the preparation of the dictionary.

AN ITEM IN PANAMA COMMERCE.—Two species of marine turtle furnish the tortoiseshell of trade. One of these (*Eretmochelys imbricata*), the hawk's bill turtle, is found only in the warm waters of the Gulf of Mexico and the Caribbean Sea. It is mostly carnivorous, and so is valued, not for its flesh, but for its shell alone. The animal is caught in the water by means of nets, or alongshore by over-turning, when it lands at night to deposit its eggs in the sand. The shell is removed in successive layers, rubbed with fine sand and then sold. Some five to seven pounds of commercial shell are derived from each turtle, and the price ranges from $3.00 to $6.00 in gold, per pound. Because England pays the best price the largest shipments go there, but a considerable amount, which enters the trade by barter with the San Blas Indians through the coasting schooners, comes to the United States. The total amount of tortoiseshell shipped from the consular district of Colon in 1905 is estimated at 16,000 pounds and valued at about $70,000, gold. For the fiscal year ending June 30, 1906, $11,219 worth was shipped from Colon to the United States.—(*Mo. Cons. Report, Aug.*, 1906.)

G. D. H.

ASIA.

THE DESICCATION OF ASIA.—Mr. Ellsworth Huntington, whose recent work of exploration in Asia, first as a member of the Pumpelly Expedition and later as a member of the Barrett Expedition is well known to geographers, has brought back what he believes to be conclusive evidence that during the last 2,000 years there has been in progress a desiccation of Asia. This matter is no new one, for many explorers in this same region have previously come to the same conclusion. Mr. Huntington, however, has matched up the evidence of tradition, historical record, topography and archæology in a more thorough way than did any of his predecessors, and his conclusions therefore carry more weight. The evidence brought forward by Mr. Huntington in a recent paper on "The Rivers of Chinese Turkestan and the Desiccation of Asia" (*Geogr. Journ.,* Oct., 1906) is of various kinds. The rivers appear to be withering; for dead vegetation is found in several cases beyond the present reach of the waters, indicating a retreat recently of 50 to 60 miles. A former greater size of certain streams is also indicated by old channels now in process of being filled with sand. Thirteen of seventeen of the larger rivers have on their lower courses the ruins of towns which date back a thousand years or more. Where there are ruins of various ages, the older lie farther downstream, and are so far out in the desert or on rivers so small or saline "that it would be impossible again to locate towns of equal size in the same places unless a far better system of irrigation were introduced." On the Endere River there are ruins of three towns of different ages, which apparently grew up one after the other, the later town in each case being smaller than its predecessor. There is water enough to-day for a large town, but it is too salt to use. In another case, on the Vash Sheri River, the former larger population "could not be supported to-day without a radical change in the system of irrigation." The lake of Lob Nor agrees with the rivers, showing signs of having been larger at no very distant date, but there is evidence also of expansion in the past, as well as of contraction.

The phenomena of rivers, springs, lakes, ruins, and vegetation all seem to Mr. Huntington to point to a gradual desiccation of Chinese Turkestan. The area of desiccation extends from the Caspian Sea eastward for over 2,500 miles. This increasing aridity he, in common with Prince Kropotkin and others, thinks must have been effective in inducing emigration of the inhabitants to other more favoured lands. R. DeC. W.

AUSTRALASIA.

The Royal Geographical Society of Australasia, founded in 1885, recently celebrated at Brisbane its twenty-first birthday by a festival extending over four days. The Society has published twenty-one volumes of Proceedings and Transactions, of which "about 80 per cent. are original contributions to geographical literature, the remainder being the result of research work in contradistinction to mere compilations."

EUROPE.

Coast Erosion in Great Britain.—The question of protecting the British coast from the attacks of the waves is now receiving serious attention in Great Britain. Two papers upon this subject, read before the last meeting of the British Association, are published in a recent number of the Geographical Journal.* In these papers it is shown that the coast-line of Great Britain is very materially different from that of its condition when the island was invaded by the Romans under Julius Caesar in the year 55 B. C. It is also shown that in many places the coast-line is receding rapidly, while in others deposits are filling up the indentations. The chalk cliffs of Flamborough Head, eighty to one hundred and thirty feet in height, are receding at the rate of a foot and a half a year. In other places, where the cliffs are lower and made of unconsolidated glacial deposits, the annual recession amounts to as much as three to five yards. Lowestoft Ness (Suffolk), the most easterly point in England, consisting of glacial drift, receded 1,100 feet between 1854 and 1901—that is, at the rate of 23.4 feet a year. There is also an outward building of some of the wave-made forelands. For example, Dungeness Point (Kent) has advanced at the rate of seven yards a year between 1689 and 1844, according to one authority. The Trinity House records show that the seaward advance of this point was at the rate of nine feet a year beween 1792 and 1850; thirteen to fourteen feet between 1850 and 1871; and eight feet between 1871 and 1897. The lighthouse on this point has been shifted seaward three times during the last century. The great mass of shingle deposited to form this point is indicated by the fact that at a distance of 100 yards from the shore, the water is four fathoms in depth at low tide, and at a distance of 330 yards, fifteen fathoms. R. S. T.

A Cartographical Museum at Geneva.—A letter received from Switzerland says that Mr. Charles Perron, the cartographer who drew all the maps and plans for Reclus in his *Nouvelle Géographie Universelle*, has organized a Cartographical Museum in Geneva, the nucleus of which is formed by the fine collection of maps that Reclus accumulated while writing his work, and which Mr. Perron used in compiling the maps. The collection has been presented to the city of Geneva on the suggestion of Mr. Perron, and the city has given several rooms in the University library for their accommodation and has appointed Mr. Perron as curator. He was also engaged last summer in preparing a separate exhibit illustrating the history of cartography down to the seventeenth century.

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* Vol. 28, No. 5, 1906, pp. 487–495. By Clement Reid and E. R. Mathews.

Mr. Perron has also constructed a relief model of Switzerland, which is exhibited in the upper hall of the University. The photographic reproduction of it, sold in map form, is a striking representation of Swiss orography.

VARIOUS.

HINTS TO TRAVELLERS.—The Royal Geographical Society has recently issued the ninth edition of "Hints to Travellers" under the editorship of Mr. E. A. Reeves. This publication, which has been of great value to explorers in all parts of the world, grew out of a small pamphlet produced many years ago under the direction of Mr. John Coles, long the map curator of the Society. From this modest beginning the book came to be the most important manual of the kind in English; and as the needs of the explorer are changing with the great advance in research, Mr. Reeves has endeavoured, in the new edition, to meet some new demands.

He says that as the days of the pioneer explorer are drawing to a close and more exact surveys are now required, many alterations have been made in the first volume and much new matter has been introduced. The aim has been to secure a higher standard of exactitude, and some of the astronomical methods which were merely approximate have been omitted. There are still travellers, of course, who might do very useful survey work by the old approximate methods, and the editor tells them how they may replace the omitted tables and instructions. The first and larger volume is entirely devoted to surveying and practical astronomy, and the second volume has the usual sections revised and brought up to date and a new section on Archæology written by Mr. D. G. Hogarth. The work continues to be a condensed treatise of the highest value to travellers.

EFFECT OF CLIMATE UPON SPEECH.—In Col. L. A. Waddell's book, "Lhassa and its Mysteries," he makes this novel observation upon the possible effect of low temperatures on speech: *

> One curious result of the cold should be mentioned here, namely, its effect upon the speech of the people. A peculiarity of the language of the Tibetans, in common with the Russians and most Arctic nations, is the remarkably few vowels in their words, and the extraordinarily large number of consonants; for example, the Tibetan name for Sikhim is "Hbrasljongs." Indeed, so full of consonants are Tibetan words, that most of them could be articulated with almost semi-closed mouth, evidently from the enforced necessity to keep the lips closed as far as possible against the cutting cold when speaking.

The Geological Survey of Ireland has been placed under the charge of Professor Grenville A. J. Cole, Professor of Geology in the Royal College of Science, Dublin.

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* Col. Waddell darkens counsel by words without knowledge. The Russians are not an Arctic nation. It is true that the territory of Russia extends to the Arctic Ocean; so does the territory of the United States and so does the Dominion of Canada. Are the Canadians and the Americans Arctic nations? It is a popular delusion that the Russian language is overburdened with consonants. Of the 36 letters in the Russian alphabet 12 are vowels and 3 are semivowels. If Col. Waddell will take the trouble to count the vowels in a printed page of Russian he will probably see a great light.

It does not appear why the inhabitants of Arctic regions find it more easy to utter their mind in consonants than in vowels, and some of them certainly do not. The speech of the Eskimos shows a full proportion of vowels.

The *Athenaeum* (No. 4125) says that many years ago Sir Clements Markham, the British geographer, became convinced that the period which witnessed the change of dynasty from Plantagenet to Tudor had been misrepresented. His new book, "Richard III: his Life and Character reviewed in the Light of Recent Research," is the result of his historical studies. The author's conclusion is that Richard III must be acquitted on all the charges brought against him in the Tudor stories.

La Nature reports that the Prince of Monaco is arranging for a first International Conference on Oceanography and Marine Meteorology, to be held, if possible, at the time of the inauguration of the Museum of Oceanography.

GEOGRAPHEN-KALENDER FOR 1906-1907.—The latest edition of this annual has a new feature—a geographical chronicle for 1905 by Prof. Paul Langhans, in which a wide variety of events of interest in geographical circles is set down in chronological order. The items include dates of the deaths of geographers, boundary treaties, great storms, landslides, earthquakes, military and political events, etc. The chief events in the field of exploration are summed up by Prof. Langhans by continents in eleven pages. Prof. H. Haack covers the geographical literature of the year surprisingly well, though, of course, not completely, in 101 small pages. This annual compilation has already won a place as one of the most convenient and helpful of the bibliographies. Dr. Haack also compiled the obituary list, covering 71 pages, with biographical information. The latest editions of the Address Books, (B) "Lehrstühle, wissenschaftliche Anstalten und Gesellschaften der Erdkunde und verwandter Wissenschaften," and (C) "Geographische und verwandte Zeitschriften," will save time, and conveniently serve many geographical workers. In Address Book B the notices of scientific establishments and societies are given under an alphabetical arrangement of the towns in which they are situated; but as some societies have no fixed abode, information concerning them appears in an appendix to the list. The map supplement contains 16 maps relating to recent geographical events.

Dr. J. Gunnar Anderson has been appointed Director General of the Geological Survey of Sweden, in succession to Dr. A. E. Törnebohm, who retires.

Dr. Sven Hedin, to whom the Indian Government denied access to Tibet across the frontier of India, is reported to have entered Western Tibet from the northwest through Chinese Turkestan.

A hint for societies publishing bibliographies at periodical intervals may be derived from the *Jahreshefte* for 1906 of the Verein für vaterländische Naturkunde in Württemberg. The volume concludes with a bibliography (50 pp.) of the literature in 1905 relating to the earth studies in Württemberg, Hohenzollern, and the neighbouring regions. A paper strip pasted around this section informs the bookbinder that it is not to be bound with the volume, but is to be kept till the next Annual shall appear, when the bibliographies for the years 1902-1906 are to be bound together, making a convenient volume of reference to the literature of these subjects for five years.

TRANSACTIONS OF THE AMERICAN GEOGRAPHICAL SOCIETY, NOVEMBER AND DECEMBER, 1906.—A Regular Meeting of the Society was held at Mendelssohn

Hall, No. 119 West Fortieth Street, on Tuesday, November 20, 1906, at 8.30 o'clock P. M.

Vice-President Tiffany in the chair. The following persons, recommended by the Council, were elected Fellows:

Frederick W. Weston.
Henry A. Spangler.
Elmer E. Wolfe.
Bertram Gordon Waters.
J. F. Vale.
Edward S. Thurston.
William Edgar Geil.
John Hubbard.
Curtis H. Veeder.
Charles Glatz.
John Shrady.
C. Arthur Moore, Jr.
Gino C. Speranza.
Charles W. Wetmore.
John A. Schlener.
George D. Hubbard.
John Barrett.
F. W. Prentice.
James Wallace Van Dusen.
Walter B. Mahony.
Francis J. Higginson.

The Chairman then introduced Mr. Richard Arthur, who addressed the Society on a Yacht Voyage of Ten Thousand Miles: Round the West Indies and Up the Amazon. Stereopticon views were shown.

On motion, the Society adjourned.

At a meeting, held on the 15th of November, 1906, the Council awarded the Cullum Geographical Medal to Dr. Robert Bell, for Fifty Years' Exploration in the Dominion of Canada; and

The Charles P. Daly Medal to Dr. Thorvald Thoroddsen for his geographical and geological work in Iceland, and his History of Icelandic Geography.

A Regular Meeting of the Society was held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, December 18, 1906, at 8.30 o'clock P. M.

Vice-President Tiffany in the chair. The following persons, recommended by the Council, were elected Fellows:

G. R. Agassiz.
William H. Andrews.
Charles E. Berner.
George F. Crane.
Samuel H. Bishop.
William Armstrong Crozier
William S. Champ.
Herbert M. Cowperthwait.
Thomas Darlington.
William C. Damron.
Charles B. Barkley.
Beverly Chew.
Charles Scribner.
C. H. Stuart-Wade.
Adolphe E. Borie.
Daniel A. Davis.
Rosa Welt Strauss.
Rowland Hazard.
Robert Emmet Farley.
Paulding Farnham.
Cecil C. Evers.
Alexis I. DuPont.

The Chairman then introduced President Peary, who addressed the Society on the Field Work of the Peary Arctic Club, 1905 to 1906.

Stereopticon views were shown.

On motion, the Society adjourned.

THE ASSOCIATION OF AMERICAN GEOGRAPHERS.—This Association will hold its third annual meeting at the house of the American Geographical Society on Monday and Tuesday, Dec. 31 and Jan'y 1, holding morning and afternoon sessions, and an evening session on Monday. The programme will include the reading of papers by members, some of which will be illustrated by lantern-slides. The BULLETIN is requested to announce that the Association extends a cordial invitation to the members of the American Geographical Society to be present at its meetings.

NEW MAPS.

AFRICA.

ERITREA.—Schizzo dimostrativo delle Vie di Comunicazione fra l'Eritrea, il Sudan, e l'Etiopia. By Carlo Rossetti. Scale, 1:5,000,000, or 78.99 statute miles to an inch. *Atti* del Congresso Coloniale Italiano in Asmara. (September–October, 1905, Vol. 1, Rome, 1906.)

An excellent map showing railroads in operation and construction, wagon and caravan roads, the commercial zone of Asmara, etc. The network of routes extends from Suakin in the north to Addis Abeba in the south, and from Jibuti in the east to Khartum in the west. This is probably the completest route map of this part of Africa.

MOROCCO.—Plaine du Sebou. Carte Levée en 1905. Par la Mission Hydrographique du Maroc. Scale, 1:100,000, or 1.5 statute mile to an inch. *La Géographie*, No. 4, 1906. Paris.

The map illustrates a paper by E. Pobeguin on the reconnaissance of the Sebu by the Dyé Mission in 1905. It is a reduction from the survey on a scale of 1:10,000, and comprises the middle part of the river between Mechra and Kçiri and Sibi bel Kheir. Fords, settlements, and trigonometrical stations are given.

AMERICA.

U. S. GEOLOGICAL SURVEY MAPS.

UNITED STATES.—Geologic Atlas of the United States, Washington, D. C., 1906. No. 140, Milwaukee Special Folio, Wisconsin. Scale, 1:62,500, or 0.9 statute mile to an inch.

The area mapped and described in this Folio covers the greater part of Milwaukee Co., and extends about a mile into Waukesha Co. The Folio contains descriptive text, topographic map, areal geology map and illustration sheet.

ALASKA.—Grand Central Special Map.

ALASKA.—Nome Special Map.

These are two of the special topographic maps of parts of Alaska, revised to April, 1906. Special surveys and maps are made of districts that, for mining or other reasons, are attracting particular attention.

U. S. HYDROGRAPHIC OFFICE CHARTS.

Pilot Chart of the North Atlantic Ocean, December, 1906.

Pilot Chart of the North Pacific Ocean, January, 1907.

UNITED STATES.—Soil Map of Newton County, Indiana. Scale, 1:63,360, or one statute mile to an inch. U. S. Department of Agriculture (Bureau of Soils), Washington, D. C., 1906.

Illustrates the soil survey of Newton Co., in the northwest corner of Indiana, bordering on the Illinois State line. Eleven distinct soil types were recognized and mapped in this area. Each of the types was found to be quite distinct, and the line of demarcation between the soils is generally quite well defined. This map is like many which the Dutch produce of their flat country, and shows one excellent use to which cartography may be applied in regions where there is little topographic relief to be expressed.

ILLINOIS.—A Provisional Geologic Map of Illinois. Scale, 1:760,320, or 12 statute miles to an inch. Bulletin No. 1 of the Illinois State Geological Survey, Urbana, Illinois, 1906.

The map was compiled by Stuart Weller from published and unpublished data, no field studies having been undertaken in connection with the work. It is a digest of material already at hand and available, and will serve as a base upon which to make corrections as the survey progresses. The location of shipping coal mines is indicated, and columnar sections for northern, central, and southern Illinois are printed on the margin.

ILLINOIS. Map showing Oil and Gas Fields of Southeastern Illinois. Scale, 1:506,880, or 8 statute miles to an inch. Bull. No. 3, Illinois State Geological Survey, Urbana, 1906.

The map illustrates a paper by W. S. Blatchley on "The Petroleum Industry of Southeastern Illinois." Deposits of oil and gas of commercial importance were discovered in 1905. The oil and gas fields are shown in red.

CANADA.—Thunder Bay, Lake Superior. Scale, 1:120,000,or 1.8 statute mile to an inch. Bulletin No. 16, U. S. Lake Survey Office, Detroit, 1906.

Prepared from the recent Canadian surveys covering this region. Thunder Bay is a fine sheet of water on which Port Arthur and Port William are situated. Most of the bays along the northern coast of Lake Superior have not yet been accurately surveyed, and must be navigated with great care,

UNITED STATES.—Vicinity of Sault Ste. Marie, Michigan and Ontario. Scale, 1:15,000, or 1,200 feet to an inch. Bulletin No. 16, U. S. Lake Survey, Detroit, 1906.

Shows the American and Canadian canals. St. Marys Rapids and other unnavigable waters are shown in blue, and the ship canals and adjacent navigable waters in white.

ASIA.

MALAY PENINSULA.—Map of Central Section of Malay Peninsula. Scale, 24 statute miles to an inch. Accompanies Supplement (Map and Itinerary) to Fasciculi Malayenses. Longmans, Green & Co., London and New York, 1903.

A good map by Bartholomew prepared from the latest surveys of the Malay Peninsula and illustrating the explorations of N. Annandale and H. C. Robinson in 1901–1902. The explorers added the positions of villages in the interior and of the jungle tribes that they visited.

INDIA.—Railway System of India. Scale, 1:5,068,800, or 80 statute miles to an inch. Administrative report on railways in India for 1905. Simla, 1906.

The map is corrected up to April 30, 1906. Railroads are coloured to show those in operation, under construction, or sanctioned, and the gauge of each. Insets show the railroad terminals in Bombay, Madras, and Calcutta. The total mileage in India is 28,295.

INDIA.—Burma. Scale, 1:6,000,000, or 94.6 statute miles to an inch. Jahresbericht der Geographisch-Ethnographischen Gesellschaft in Zürich, 1905–1906. Zürich, 1906.

A series of four black-and-white maps illustrating a monograph by Dr. Hans J. Wehrli on the "Industrial Geography of Upper Burma and the Northern Shan States." The maps show the boundaries of the districts and their capitals, meteorological stations, the annual distribution of rainfall, the distribution of rice and other crops, and the density of population.

EUROPE.

HUNGARY.—Niederschlagskarte des Theissgebietes, 1891–1900. Scale, 1:2,000,000, or 31.56 statute miles to an inch. By P. Vujevic. *Geographische Abhandlungen.* Vol. 7, No. 4. Leipzig, 1906.

A black-and-white map of the Theiss basin with seven symbols to show the quantitative distribution of rainfall. The maximum precipitation is in the N. E. Carpathians, the source region of the Theiss, the Lower Tatra, and in the Siebenbürgen plateau lands and mountains.

POLAR.

ANTARCTIC.—Expédition Antarctique Française. Commandée par le Dr. Charcot. Scale, 1:2,800,000, or 44.19 statute miles to an inch. *La Géographie*, No. 5. Paris, 1906.

Illustrates a paper by Dr. Charcot on the scientific results of his expedition of 1903–1905. The west coasts of Graham Land and Danco Land and of the neighbouring islands which Dr. Charcot surveyed are distinguished from those previously outlined.

ATLASES.

ATLAS OF THE WORLD'S COMMERCE.—Compiled from the latest Official Returns at the Edinburgh Geographical Institute. Edited by J. G. Bartholomew. (Parts 14 and 15.) George Newnes, London, and Frederick Warne & Co., New York, 1906. (Price, 25 cents a part.)

Coloured plates show the mean annual rainfall with limits of snowfall, the prevailing winds, distribution of climatic diseases, density of population, distribution of white, yellow, and black races, of religions, of the ten chief languages of commerce, and a double-page Mercator map showing the various degrees of commercial development. Mr. Chisholm's "Introduction to Economic Geography" is included in Part 14 and a Commercial Gazetteer of the countries and ports of the world with black-and-white maps of leading ports is begun in Part 15.

BOOK NOTICES.

Otfried Nippold, Ein Blick in das europafreie Japan. Frauenfeld, Huber & Co., 1905. 56 pp. 8vo.

The title of this little pamphlet is somewhat unhappily chosen. The author means to speak of those sides of Japan which are uninfluenced by European culture —*i. e.*, chiefly the domestic and inner life, the philosophy and the leading ideals. That European culture conquered Japan merely in its technical aspects, and is nothing but an outward polish, which never affected very deeply the hearts of the Japanese people, was never doubtful, and it is a fact by no means to be deplored. The paper is a popular essay, pleasantly written for the enlightenment of the public, in regard to the real conditions of modern Japan, and exhibits those slight, erroneous conceptions to be found in all authors who are not familiar with the country through a personal visit; as may be seen, for instance, by his remark on p. 7 that there are no tailors and seamstresses in Japan; or by that on p. 9, where he mentions that both sexes bathe together, which custom was forbidden decades ago; but as he draws from reliable sources, chiefly Rein, Rathgen, Chamberlain, Hearn, and some Japanese authors, he is in general fairly correct. At the end, Nippold submits the question of the world-mission of Japanese culture to a brief discussion, and gives it as his opinion that the influence of the sound mental forces of Japan upon "our culture, somewhat decrepit and evidently incapacitated in many regards," would be beneficial, and should be hailed with honest joy. We fully concur with the author in his judgment, but dissent from him in his prophecy that this moral influence will be felt only at some future time, when Japan shall have created her political and economical position, because we believe that this influence has been in full force and been making rapid strides forward for a long time, as evident to any impartial observer by many palpable symptoms. What our author designates as "Japan free from Europe" is simply the ideals of Chinese civilization, on which the greatness of Japan rests; these and the ideals of the West represent nowadays the two great contrasting and struggling principles in the world's civilization. If the final victory of the white race over the peoples of the globe was once doubtful, it is so now more than ever before, and it is now left to the white race to reform and to regenerate itself by learning from the ideals of the East, or, if not, to cede its seeming and merely visionary supremacy to the East Asiatics, which would not be a calamity, but a blessing for the furtherance of the good cause of true civilization, in which the Japanese doubtless are now taking the lead. A mutual fertilization between our own culture ideas and the highest ideals of the East, and an amalgamation of the substance of the leading principles of the two culture spheres, might finally result in a superior form of cultivation, in a higher concept of the standard of living, in a more intimate, more artistic growth in the conduct of life, greater, perhaps, than we should now ever venture to realize. B. L.

Baron Suyematsu, a Fantasy of Far Japan; or, Summer Dream Dialogues. London: Archibald, Constable & Co., 1905. 337 pp. 8vo.

Written in the form of dialogues, in a graceful, conversational style, this book is very well suited to while away an idle hour or two in pleasant company with as much profit as enjoyment. In the atmosphere of a Parisian salon, with the verve and esprit of a Frenchman, the baron talks freely and fluently, with the attitude of a man of the world, on the notions and ideals of his country; naturally, these causeries are not very deep, but they are always entertaining and instructive; to all questions put to him by his interlocutors he has something interesting to say and worth while listening to, especially in the comparisons which he draws between Japanese ideas and our own. He thus defines, for example, the difference between the notions of our mediæval and of Japanese chivalry of the Samurai (p. 42): "With your chivalry the custom of rendering respect to the fair sex had been carried to such a high pitch that it was nothing less than adoration or worship. I do not say the motive was originally bad, because it came no doubt from the idea of helping the weaker. But, remember, it often happened that too much prominence was given to keeping faithfulness to women, even where one had some higher duty which ought to have claimed the whole loyalty of his heart. The subject is rather too delicate for me to describe minutely, but you can see what I mean. In the days of your chivalry faithfulness in love affairs was looked upon in general as gallantry, no matter whether the affair was honourable or otherwise; but with the Japanese Bushido it was different. It was not because a Bushi was heartless toward the weaker sex, but effeminacy was a thing which he despised most. In the days gone by in Japan, if a Bushi had been found paying too much attention to a lady, and making himself a slave to her, to the neglect of his duty, he would have been hooted out of society. With European chivalry, therefore, the tendency of desire was to be noticed by others for his actions performed in homage to a lady, whilst with our chivalry one would try to do his utmost to conceal his emotion, and even to look cold. In the West, therefore, the word 'gallantry,' which was originally used more for 'dashing and noble bravery,' came in common parlance to have quite a different meaning, as you know. Nothing of the sort has ever taken place with us." And, further: "There was also another great difference. In the West chivalry had grown and decayed, traversing always pretty much the same line; I mean it had undergone no great transformation. But in Japan the case was somewhat different. There it became united with the art of intellectual learning, and has made Bushido, that is, the ways of Bushi, more systematic and ethical . . . Broadly speaking, I can say that in the West friendship or affection moved more towards intimacy, whilst in the East it moved more towards respect." Valuable from a scientific point of view is his discussion, then, of the history of the term *bushido* (p. 103 *et seq.*), which, in his opinion, is by no means modern, as usually accepted by foreign scholars, but occurs as early as in the middle of the Twelfth Century in an historical record, the Hogen Monogatari. In the fourteenth century an ethical doctrine for Bushi was expounded by Shiwa Yoshimasa, a Japanese general (1349–1410). Since 1608, when Bushido made great systematic progress on its literary and intellectual side, many treatises on the subject have been written by eminent scholars.

Interesting are also his judgments on Lafcadio Hearn (pp. 74–76, p. 86), of whom he remarks, not quite unjustly, that he tried to reason out some points of Japanese life which are not altogether to be explained by ordinary reasoning, as entirely resting on the spirit of feeling and sentiment. He finds, also, that Hearn lays too much stress on the notions of ancestral worship, the extent and bearing of which the reviewer thinks is usually overrated.

To the charge of untruthfulness frequently thrust upon the Japanese, he replies, much to the point, as follows (p. 116): "This kind of charge is the commonest method which the Occidentals employ when they talk about the character of other races, which they generally regard as inferior to themselves. But mere common-sense will tell them that that there can be no human community, even amongst undeveloped tribes, where the word *lie* is not a word of reproach, if only the smallest element of a moral notion exist; and there can hardly be any human community where there is no such moral notion at all." As regards the general moral conditions, he is inclined to think that, taken as a whole, the social structure of Japan is, in reality, far cleaner than that of most countries (p. 117), but that she was even better in that respect in the days gone by (p. 118); on the whole, the morality of the individual was higher in the old days, because those days were more simple, and the community more sober; the more primitive a land is, the better it is morally. People were happy in former days, because they did not know what freedom meant; still less the enjoyment of the luxuries to which they are now accustomed. To them ignorance was literally bliss. But the idea of happiness, nowadays, differs in kind and character; and it is difficult to say if modern Japan is as happy as the ancient Japan (p. 123).

The Baron does not believe in the desirability of intermarriages between foreigners (p. 159). There have been, of course, he argues, many intermarriages between the Japanese and the Occidental races, and the results of some of them have apparently been very good. But there have also been many failures; and he does not think, in general, that happiness can be secured by intermarriages of this kind so much as by those between people who have greater resemblance to each other in customs and manners and everything else. Even if the couple are happy, it often happens that it is not so between them and their relations.

There are several useful appendixes treating of the political organization of the empire, education, Anglo-French diplomacy in Japan forty years ago; sketches of some chief figures in Japan of to-day; a speech by Marquis Ito made in Washington 34 years ago; commercial morality of the Japanese; Japan and foreign capital; the languages of China and Japan, once more on Japan and France, Japan and Europe, the Indo-China question, the Australian question, the Anglo-Japanese alliance and America. It will be readily observed that this is the book of a many-sided, thoughtful writer, who is not wanting in topics, in questions, and answers. B. L.

Lantern Illustrations for the Teaching of Meteorology. Edited by Henry J. Cox and J. Paul Goode. Bulletin of the Geographic Society of Chicago, No. 3. 8vo. 1906. Pp. 130.

In 1905 the Geographic Society of Chicago undertook the task of collecting a set of lantern-slides for use in meteorological teaching, and appointed a committee to take charge of the work. On this committee, in addition to Professor J. Paul Goode, then president of the Geographic Society, were Professor Henry J. Cox, in charge of the Chicago station of the United States Weather Bureau; the chief observer of the same station, and three teachers. The committee has completed its work, and has selected a set of 270 lantern-slides, which it is selling at cost price. In connection with the slides there has been published a *Bulletin* giving an adequate description of each slide, together with a list of books and other materials for use in teaching, and two general papers, an introduction by Professor Cox, and a paper on the use of the lantern in teaching, by Professor Goode. The slides, which cover all the subjects usually included in general meteorological instruction, consist of maps, diagrams, photographs, etc., and were selected from the large number of available illustrations in the *Atlas of Meteorology*, in recent text-books, in meteorological journals, and the like. They also include a considerable number of photographs, as well as of weather maps and weather records, which were prepared by the committee. These slides will prove of great and lasting value to all teachers of meteorology. The Geographic Society of Chicago, and especially Professors Cox and Goode, deserve and will surely receive the hearty thanks which are due them for their painstaking and wholly unremunerative labours. And meteorological teaching in the United States will be given a further, a most effective, and a much-needed stimulus. We regard this publication, with the slides, as one of the more important American contributions to meteorological education in recent years. R. DEC. W.

Étude sur la Situation de l'État indépendant du Congo. Félicien Cattier. Seconde Edition. Bruxelles et Paris. 1906. (3.50 fr.)

This mainly controversial and polemic book bears to a certain extent on geographic topics, through the statistics it presents of some branches of the production and income yielded by the Congo Free State. But its main object is political, in that it takes part in the Congo controversy begun by England in 1893 and carried on since with considerable bitterness on both sides. With that controversy we have nothing to do; it is a political matter. and we confess ourselves unable to formulate an opinion on the merits of the case. Since where there is smoke there must be fire, it seems likely that at least some of the attacks on the Belgian Government, perhaps personally on the Sovereign himself, are justified, but we have not been able to understand by what right England and the English can claim interference in the affairs of another nation. It is and has been, however, English policy or English tactics, since the sixteenth century, to divert the attention of other nations from the failings and crimes of England by raising a hue-and-cry concerning abuses committed elsewhere, and in these tactics the establishment of the truth has been subordinate to the creation of a certain effect. The world, at last, has caught a glimpse of these methods; they have grown stale and transparent, and the inventive genius of the English might well produce new ones to cover up their sins or to initiate plans of expansion at the expense of others. These slight objections to the opening of the anti-Belgian campaign with regard to the Congo having already been raised during its progress, we merely allude to them without discussing their merits.

Professor Cattier makes two declarations which place him on firm ground. He says:

> I believe that, under the actual political conditions of Europe, a monarchical form of government is the one that serves best the interests of the country.

And again:

> I harbor the firm conviction that the Congo is not only useful and necessary to Belgium, but that, besides, Belgium could not give it up without incurring a grave moral forfeit.

While a strict partisan of the charges made against the present administration of the Congo, the author declares that, in his eyes, the radical remedy for the situation is annexation of the Congo to the Belgian kingdom, thus putting an end to a situation which is dubious aud ill-defined. That remedy is certainly patriotic from his standpoint, and it may yet prove to be the only practical one.

Professor Cattier reviews the wrongs which the natives are said to suffer in considerable detail. His aim is to refute the report of the Investigation Committee on the affairs of the Congo, and to expose defects in the workings of that commission. In the course of his scathing and merciless review, great abuses are brought to light, although the administration of colonial domains by England, for instance, has had phases which throw the alleged Belgian misdeeds considerably in the shade. The present work does not by any means close the dispute; and while giving every credit to Mr. Cattier for sincerity of purpose and honesty, we must wait for the other side to reply. They are certainly entitled to a hearing. A. F. B.

Die Vulkanberge von Colombia. Alfons Stübel. (Edited by Th. Wolf.) Dresden, W. Baensch. 4to. 1906.

This posthumous work of the distinguished geologist and explorer is a complement to the one published during his lifetime—"Die Vulkanberge von Ecuador." The latter appeared in 1897, seven years previous to the death of its lamented author. The editor (himself an authority on the geology and vulcanology of Ecuador) has made but very few changes in the original text, and has always carefully noted when such was the case. In regard to the last section of the book: "A Glance at the Workshop of Volcanic Forces," Mr. Wolf declines any participation or responsibility. He has given the words of the author without commenting upon them. It is the third part, and exclusively theoretical. Aside from voluminous tables of geographical positions, distances, and meteorological observations, the bulk of the text is devoted to explanations of the numerous and very valuable views of the volcanoes of Colombia. These views, mostly copies of drawings made by Dr. Stübel on the spot, are executed with the utmost care and the greatest attention to characteristic detail. To these handsome plates are added a map of the volcanic region of Colombia based upon the one by Codazzi, one of the volcano of Tolima, and a sketch map of the group of Cumbal and Chiles, all by the hand of Stübel. Whoever has lived in the higher mountain regions of South America cannot fail to bear testimony to the truthfulness with which the solemn, grand, but bleak and forbidding landscape is rendered by Stübel's skilful pencil.

In treating of the volcanic mountains of Colombia, Stübel very naturally does not include the Isthmus of Panama:

> It forms, with its trachytes and basalts, something like an ancient volcanic bridge between the new volcanic regions of South and Central America.

The volcanoes of Colombia cluster in three groups. The most northern and the most southern are the best-known; the former including the Tolima, the truncated cone of which is quite characteristic. The southern group is that about the volcano of Pasto, of the pre-Columbian eruptions of which traditions are preserved from the time of the Conquest. The highest of all is the Huila (18,860 feet), nearly equidistant between the two. Stübel enumerates seventeen cones, few of which are now active. He merely alludes to the volcanic chain of "La Fragua," for the very good reason that it has never been explored or even visited by scientific explorers, although its appearance, from a distance, would lead to the inference that it is volcanic. With the exception of that mountain or range, the central Cordillera of Colombia alone has volcanoes, both the eastern and western branches being free from eruptive centres.

To follow the author through his elaborate descriptions of every one of the volcanoes illustrated in the volume is out of the question. We can only mention them in acknowledgment of his thoroughness. They are interspersed with some ethnological notes, for instance, on the Sebondoi Indians near the Putumayo. More attention is attracted by the theoretical part of the book (III), the one in which Stübel's theory on vulcanicity is expounded. It is not new. He had treated the subject already in connection with the volcanoes of Ecuador only; in this last discussion he draws most of his material from phenomena presented by volcanoes of the Mediterranean, beginning, of course, with Vesuvius and the eruptions (submarine) near Santorin.

The history of these eruptive centres is the longest and best-known, hence far better studied than those of any other part of the globe. Still, it may be regretted that Stübel did not extend his discussion of volcanic action to other regions with which he was specially familiar. He assumes:

> The volcanic phenomena of the present—in so far as the sum of observed facts allows an opinion—have their origin in localized, that is, circumscribed, and hence exhaustible, centres, and not in a common central focus, placed at incalculable depths and common to all volcanic phenomena of the earth's surface.

Still, he regards the existence of a great central hearth as not improbable, although its reactions towards the earth's crust no longer reach the surface. Every volcano is, therefore, in dimension and form, a picture of the peripheric hearth (so Stübel defines it) by which it has been created, and the violent manifestations of such a focus, called eruptions, tend to re-establish an equilibrium disturbed by excessive accumulations of incandescent matter or "magma," by ejecting that matter to the earth's surface. These restorative crises have produced themselves in many cases but once, in others twice and even more often, and what we call a volcano in a permanent state of activity is in fact not the beginning but the *close* of the eruptive state, the final emptying of the hearth and its return to complete rest. The duration of the crises and the length of intervals (affecting a certain periodicity) between them are, of course, indeterminable, since their causes lie hidden from direct observation; but each may last untold centuries.

The first eruption is the one that has given form and has outlined the bulk of the mountain. It has not always culminated in an ejection of incandescent matter; quite as often the formation of a huge swelling has been the only visible outcome. But from the phenomena presented by the volcanoes of Mediterranean Europe, or by the Azores, etc., upon which the author lays particular stress, that earliest protuberance was followed by the appearance of a second one (after an undetermined period) alongside of or superimposed on the first upheaval. Eruptions subsequent to the latter initiate the dying out of the "peripheric" focus, its final emptying, and this stage Dr. Stübel characterizes as what is generally called "permanent activity."

As closing scene of the whole, he suggests that a remnant of the liquid eruptive mass, unable, from its reduced quantity or from lack of lifting power, to reach the rim of the opening, sinks back into the depths out of which it has risen. The consequence would be a crumbling of the walls of the pit, followed by a collapse and filling up by débris from the upper sections. In this manner the conic or dome-shaped form would result, proceeding, not as hitherto admitted, from successive heaping up of erupted material, but from a process of interior crumbling. It would not be a phenomenon of accumulation but one of reduction, accompanied by a closing of the original channels.

Dr. Stübel inclines to the belief that the most colossal volcanic mountains are the result of the earliest "reactions of the earth's interior against its shell," as we might say, paraphrasing the well-known expression of Humboldt, from a time when that shell began to solidify. The continuance of that reaction in its present form he also considers as probably due to further retraction, forming focuses made incandescent through pressure, "peripheric hearths," at a much lesser depth than the hypothetic fiery nucleus, the actions of which are no longer perceptible on the earth's surface.

These are, in the main, the distinguished scientist's theoretical views on terrestrial vulcanicity. It behooves us not to discuss them. The ultimate form of a volcano regarded as extinct, whether a closed cone or dome, or a mountain having in its summit a cauldron-like depression indicative of an extinct crater, is attributed in the main, by Stübel, to a collapse of the conduits through which the eruptive material was wont to emerge. There are instances, however, when the summit seems to have been shattered as if by a tremendous explosion. The craters of the long-extinct volcanoes of Quimsa-pata near Siuani in southern Peru, and the history of the formidable eruption of Omate (also in southern Peru) in 1600, might lead to the surmise that a part of the top was actually removed or blown off by the eruption and its mass reduced to ashes and lapilli (chiefly the former), scattered over an enormous area. While it may not have been the principal agent in shaping the mountain as it is now, the suddenness of the outbreaks (in the case of Omate and Mont Pelé), their coming on without premonitory symptoms and with a violence hardly equalled again during the continuance of the cataclysm, the enormous amount of finely-pulverized matter scattered broadcast over thousands of square miles, seem to favour the conception of an explosion to which, at least, the beginnings of the shape of the mountain as it is now may be due. A retreat of the remaining incandescent mass towards the earth's interior has certainly contributed to modify the form thus first produced, by enlarging cavities and widening its rim through cavings and slides, but the initiatory explosion can, it seems, hardly be overlooked as a factor. Besides the examples quoted from South America and the Antilles, the catastrophe of Tamboro on the Island of Sumbava (1815), of Coseguina in Central America, of Krakatau near Java, recall similar causes. It is perhaps a question whether the, not very rare, cases when eruptions of appalling violence came without premonitory symptoms should not be attributed to explosion from within, and the removal of their summits to that force rather than to a retreat towards the interior. A. F. B.

Cities and Sights of Spain. A Handbook for Tourists. By Mrs. Aubrey Le Blond (Mrs. Main). xv and 214 pp., many illustrations from photographs by the author, index, and map. George Bell & Sons, London, 1904.

In three visits to Spain the author travelled about 6,000 miles. Her book is meant to supplement the guide-books, and especially to make it easier for tourists, while in Spain, to get along without most of the books that are still thought to be essential to travelling in that country with most enjoyment and profit. She thinks that no other part of Europe "offers so varied and attractive a field to nearly every type of traveller." The Spanish Government and people are now exerting themselves in many ways to make travel pleasurable, and to turn a larger part of the tide of tourists in their direction, with the result that the number of travellers is increasing every year. This is a thoroughly helpful and an interesting little book. A black-and-white map gives the plan of a tour that includes practically all the points of interest in the country. Travelling in Spain seems to be cheaper than in most other European countries. The author found on her second tour that for five weeks and three days in Spain the cost was $150, including first-class fare on the railroads and the best hotels.

The Masai, their Language, and Folklore. By A. C. Hollis. With Introduction by Sir Charles Eliot. xxviii and 356 pp., 27 Plates of Illustrations, Index, and Map. Clarendon Press, Oxford, 1905. (Price, 14s.)

Mr. Hollis is Chief Secretary to the Administrator of the British East African Protectorate, and is well known for earlier contributions to African anthropology. For ten years he had large opportunity to study the Masai, and his linguistic talent and anthropological training have enabled him to get at the heart of their mental and physical life. The result is a work of great thoroughness and excellence. He has produced the best book in English on this important African family.

The Masai live in the inland districts of British and German East Africa, between the Equator and 6° S. Lat. Most of them have been pastoral nomads, but there is also a small agricultural element. Until about twenty-five years ago they were the most formidable tribe in East Africa. They kept the Arab slave traders at bay, levied heavy tribute upon all who passed through their country, delayed for years the exploration of tropical East Africa, and treated all other races with the greatest arrogance. But the past quarter of the century has been disastrous for the race. Most of their cattle were swept away by rinderpest, great numbers of the tribe fell victims to smallpox, neighbouring tribes rose against them in their weakness, and their numbers were further reduced by famine. It is believed that only 12,000 to 15,000 are now living. To save them from extinction Mr. Hollis says that:

> Every support should be given to the Church Missionary Society and to the other missions, for it is only by the gradual and peaceful civilization of the tribe that they can be saved from extinction.

What Mr. Hollis has done in this book is to place within reach of all a knowledge of the language and customs of the Masai. Comparatively little has been known of this language, and Hollis's exposition of it will be of interest to philologists and of practical importance to the whites, who, in increasing numbers, are coming into contact with the natives. As Sir Charles Eliot says, if one wishes to be on friendly terms with other races, and to avoid misunderstandings, the first essential is to speak their language. The Masai are delighted to converse with Europeans, and if they had been capable of giving or receiving explanations when trouble was brewing much disastrous misunderstanding would have heen avoided.

Mr. Hollis gives 101 pp. to the grammar, including rules for pronunciation, and a large vocabulary. He has made the grammatical system of the Masai language coherent and clear. The language has many peculiarities. It shows a marked inclination for long formations, and until the articles, relatives, verbal prefixes, and affixes have been separated, it is impossible to discover roots, or even the simple forms of nouns and verbs. Much still remains to be done, but the general structure of the language appears at last to be established beyond doubt.

Nouns in Masai are not susceptible of any inflections to mark the cases; but the article has special forms to denote the nominative, vocative, and genitive. Many substantives are derived from verbal roots. Perhaps the most complicated part of the language is the formation of the plural of nouns; and Mr. Hollis gives 17 pp. to the discussion of this topic. There are no degrees of comparison in the forms of adjectives, and the author shows the various ways in which the comparative and superlative are expressed. Forty-nine pp. are given to the verb. There are few conjunctions, no real prepositions, but a large number of interjections.

Two-thirds of the book are devoted to the stories, proverbs, riddles, and songs, and to an account of the customs and beliefs of this interesting people. A delightful peculiarity of this long narration is that the whole is given in the words of the Masai themselves, which were put on paper in their language as the author received his information. The English translation is printed, line by line, under the Masai words, or the two are presented in parallel columns.

The stories, songs, and proverbs show considerable imagination, and naturally bring into clear light the ideas and motives at the basis of the native character and life. Their proverbs often give the essence of our own. "Do not jump about, for there is no use in it," is another way of saying "The more haste, the less speed." "We begin by being foolish, and we become wise by experience" is, of course, only another form of "Experience is the best teacher." The Masai say "Flies have ears," and we say the same thing of "Little pitchers." "Mountains do not meet" is often said when persons part company, and is equivalent to the Turkish proverb, "Mountain does not meet mountain, but man meets man."

The long section on Masai customs covers many phases of their migrations, work, attire, ceremonials, weapons, military code, social ideas and habits, religious beliefs—which are vague and unformulated—crimes, etc. Here is a simple account of Masai fire-making:

> When the Masai move and go far, the men take with them, or cut on the spot where they intend to stay, a hard pointed stick and a flat piece of wood. They then search for some donkey's dung or dry grass, and produce fire in the centre of the new kraal by drilling the stick into a hole in the wood. When the fire has reached the grass they set light to some leaves of *Cordia ovalis* and throw wood on to the fire. The women obtain their fire from the one which the men have made. When the journey is a short one the women carry fire with them.

Sir Charles Eliot, formerly Administrator of the British East Africa Protectorate, supplies an introduction in which he discusses the still vexed question of the origin of the Masai and compares them, as to their language and customs, with other East African and Nilotic tribes. The book is one of the most striking of recent illustrations of the great progress we are making in knowledge of Africa and of its peoples.

The Geology of the Hokitika Sheet, North Westland Quadrangle, with which has been included a small portion of the upper Wilberforce valley, in the Waimakariri Quadrangle. **By James Mackintosh Bell, assisted by Colin Fraser.** Bulletin No. 1 (New Series) New Zealand Geological Survey, Department of Mines, Wellington, New Zealand, 1906. xi and 101 pp., 32 plates, 9 maps, 4 geological sections and 11 micro-photographs.

Every new country must apparently be explored at least twice before it can be said to be fairly well known—once by the explorer, who, in a rapid reconnaissance, discovers the existence and location of its mountains, plains, streams, peoples, etc., and again by the trained geographer or geologist, who, by later detailed examination, checks the earlier determinations, discovers or works out the genesis and relations of structure, topography, and drainage, and describes these in systematic terms, thus making the region intelligible to those to whom all lofty snowclad mountains or low coastal plains are not alike.

New Zealand will certainly become well known in the latter way, if succeeding bulletins of its recently-reorganized Geological Survey live up to the promise of this the first number in the new series, by Dr. James Mackintosh Bell, the Director.

The volume is of special interest to the geographer by reason of the two important chapters, "General Culture" and "The Physical Geography of Westland," in which are described the towns and settlements, means of communication, inhabitants, flora, fauna, soil, and climate of the area referred to in the title. A considerable part of this section is also devoted to a well-phrased description of the most important topographic features.

Westland has long stretches of harbourless coast; and even where harbours occur they are frequently shallow and difficult of entry—a fact which greatly retards the development of the district. Overland communication with the eastern and better-favoured parts of the island is by means of a few roads and more frequent bridle-paths and trails. The last named were used for generations by the Maoris, who migrated to the west coast, and in calm weather searched the shores in canoes for the much-coveted greenstone.

The chief physiographic provinces of Westland, named in order from the hinterland to the shores of the Tasman Sea, are an alpine chain, with many splendid and lofty snow-covered peaks; an elevated and now well-dissected peneplain 4,000 to 5,000 feet above the sea, surmounted by an occasional rounded residual mountain; and a young coastal plain with outliers of the peneplain on its inner margin.

The general direction of the alpine chain is northeast. The structure is synclinal in the main, and the highest peaks consist of grauwacke or sandstone, and stand at elevations varying between 6,000 and slightly over 7,000 feet. Avalanches of snow are of common occurrence at the heads of the higher valleys. These are sometimes of huge proportions, and bring down as low as 3,000 feet quantities of snow so large that they are frequently not melted by the heat of the ensuing summer. Almost every alpine valley has such masses of hardened snow at its head. The glaciers themselves are not large, but are the shrunken remnants of once extensive ice fields and glaciers. An interesting circumstance is the absence, with one exception, of rock-flows in the streams draining the glaciers, due, no doubt, to the inefficiency of the present weak glaciers in eroding the beds of hard rock scoured clean by the former powerful ice-sheet. The common phenomena of glaciation are noted at low as well as at high elevations, and Bell's work on the glacial and fluvio-glacial deposits of this district constitutes, with the work of Agassiz, Gregory, Andrews, Thatcher, and many others, convincing proof of former more extensive glaciation in the southern as well as the northern hemisphere. *Roches moutonnées*, glacial striæ, and glaciated boulders are common, and can certainly not be questioned in view of the author's extended experience in the glaciated regions of Canada. The V-shaped valleys, represented in the plates and described in the text, are indicative of strong ice erosion, as are also the abruptly truncated spurs of the pre-glacial valleys and the frequent cirques, rapids, falls, and hanging valleys.

The uplifted peneplain (Wainihinihi) has been very deeply dissected, and near the major streams is distinctly mountainous, so that the principal elevations here receive distinctive names—a feature similar to that noted in the Acadian peneplain by Daly. Alpine or subalpine vegetation is found all over the surface of the peneplain, the ranges being quite free from snow at the close of summer. The sides of the valleys carved below the level of the uplifted plain have been smoothed and steepened by ice-action in a significant manner.

The coastal plain, fronting the Tasman Sea on the coast of Westland, is a very complex physical feature. Three distinct cycles of development are noted : an early cycle, in which beds of gravel and clay were raised above the sea and dissected ; a second cycle, in which this dissected plain was submerged, partly buried under new sediments and elevated with remnants of the older plain, standing in relief above the modern feature ; and the present third cycle of development, in which the valleys have become extensively terraced. The present cycle has been complicated by glaciation—a fact accounting for the tremendous amount of irregularly-deposited glacial débris forming much of the surface of the modern coastal plain. The greatest width of the plain is fifteen miles, and the maximum elevation of its inner margin about 600 feet.

Special attention is directed to the maps and excellent photographs accompanying this report, which depict the topographic features, the drainage, the glaciers, etc., of a district practically unknown to American geographers, although earlier papers dealing with other sections of New Zealand had portrayed more or less similar features elsewhere.

It is hoped that future publications in this series will extend the geographic as well as the geologic work begun in the first *Bulletin*, that by this means we shall soon be enabled so have a thoroughgoing and complete regional geography of this interesting island group.

I. B.

Uganda to Khartoum: Life and Adventure on the Upper Nile. By Albert B. Lloyd. xii and 312 pp., 80 Illustrations, and map. E. P. Dutton & Co., New York, 1906. (Price, $3.)

This is a record of travel, adventure, and work among the natives of the northern provinces of the Uganda Protectorate, a part of Central Africa very little known to the public. The author is a missionary who has lived ten years in Uganda. His latest book depicts his experiences during a five-years' residence in the northern provinces and describes his journey down the Nile on a vacation trip to Europe.

Mr. Lloyd is one of the comparatively few men who have special capabilities for such pioneering service as he has rendered in Africa. His book is interesting and instructive. It is not a missionary work, and it deals briefly with missionary effort; but it presents Africa as a land of darkness, of fascinating adventure, and of immense possibilities, in whose future the author has unbounded confidence.

The numerous half-tone illustrations give glimpses of many phases of life in Central Africa that could scarcely be imparted so vividly by any written description. Many of them give entirely new aspects. One, for example, shows some half-clad natives in the foreground, while behind them, on the well-built highway, is a black man, naked to the waist, leaning on his bicycle. We are introduced to the new industries which the whites have taught to the people, such as lumber and brick manufacture. Another plate shows the interior of the Cathedral of St. Paul at Mengo, which holds 3,000 persons, and in whose construction 750,000 brick were used. Times are changing in Africa, and no book illustrates the fact better than this volume.

Mr. Lloyd founded the mission in the province of Bunyoro, which, not many years ago, was the scene of the inhuman practices of King Kabarega and the bands of robbers that he turned loose to prey upon his own people. Bunyoro's misery is now in the past, and the country is holding up its head again; for it has a Christian king, a son of Kabarega, who takes genuine delight in the most energetic efforts to uplift and help his countrymen. Medical missions and the civilizing influences of industrial education are accomplishing great things in Bunyoro.

The geographical interest of the book is chiefly centred in the description of the remote Acholi country, a little-known region north of the westerly bend of the Nile. After his mission in Bunyoro was well on its feet, Mr. Lloyd went among the Gang, as the people of Acholi call themselves, to begin his civilizing work in that virgin field. He impresses us with the fact that many of these barbarous tribes are learning of the helpfulness which the whites have brought to other African peoples and are eager to enjoy the same advantages. This was the case among the Gang, who were reputed to be dangerous and inhospitable; but they have opened wide their doors to the white teacher, and his work now flourishes among them.

Their country is a region of fine, open plains, above which rises, here and there, a majestic mountain. Tropical forests are scattered over the plains; and though the heat is intense in the lowlands bordering the Nile, the climate of the eastern uplands is healthful to Europeans. In Mr. Lloyd's account of these formerly mistrusted barbarians, he emphasizes the high average morality among them.

His description of the journey down the Nile is the first detailed account we have seen of the conditions of travel there, now that steamers make regular trips between Khartum and Gondokoro. The book is one of the best works on the regions of which it treats, and it completely illumines the present conditions there.

Highways and Byways of the Mississippi Valley. By Clifton Johnson. xiii and 287 pp. and 63 illustrations. The Macmillan Company, New York, 1906. (Price, $2.)

Mr. Johnson followed the river from New Orleans to near its source, and, in his desire to avoid aspects with which all are familiar, he chiefly haunted the byways, travelling on the country roads, living among the people, and studying their lives and toil. His literary material deals with the unhackneyed and unconventional. He has garnered the quaint, the characteristic, and the little known, and tells much of his story in the monologue and the dialect of his informants. As his narrative abounds with anecdote, and his descriptions are clean-cut and photographic, his work is both entertaining and edifying. He is a keen observer, and has an eye even for the little things that reveal character and conditions.

Mr. Johnson is certainly one of the first authors to give a vivid description of the swamp region of the lower Mississippi, where he made the acquaintance of moss-pickers, and was rewarded for his hardships with much novel material for his book. The reader is certain to become interested in Jake, an alligator hunter whose energies are given to catching little alligators to be shipped to menageries, or to any one who delights in that kind of a pet. Jake is photographed in the act of pulling a young alligator out of his hole by the snout. The photographs are unusually good, and most of them illustrate phases of life among the lowly. Mr. Johnson has written a considerable number of books, but none of them contains more new information of interest to readers than this volume.

Algiers. By M. Elizabeth Crouse. Illustrated by Adelaide B. Hyde. xii and 244 pp., 24 illustrations, and Index. James Pott & Company, New York, 1906. (Price, $2.)

The author lived five months in Algiers taking notes for this volume. She has also been in Tunis, has spent a winter in Egypt, and it seems to her that in neither of these countries "does the Oriental life compare with that in Algeria, both for grace and beauty." Her book is filled with vivid pen-pictures of the monuments the Deys left behind them, and of the lives of the people among whom Western civilization has been introduced by the French. She sees the spirit of the East still alive and poetic beauty and charm still pervading the old Moorish villas, gardens, and mosques ; and with sympathy and enthusiasm she tells the story of this city where the East and the West have met, threads the narrow passages of the old town to study the monuments of what has been, and mingles the history and the romance of the old palaces in giving her impressions of them.

We usually hear more of Algiers than of Tunis, and many persons imagine that the former city is materially more important. The fact is that Tunis is nearly three times as populous as Algiers, and the author makes some interesting comparisons between them :

> Tunis is not nearly so beautiful as Algiers, for it is flat upon the sand and lacks the stately arches of the arcades and of the ramparts which conceal the steep cliffs at the foot of the latter city. . . . The whole difference between Tunis and Algiers might be summed up as follows : In Algiers the Arab life is buried, the city belongs to the French, and the French are destroying the Oriental to build a modern Western town. In Tunis the Arab life goes on in all its vigour, protected, not suppressed by the French, who may not destroy anything. Neither are there the oppressive taxes and heavy duties of Algiers. It is therefore much more prosperous and appears so even in the French settlement. And yet the Algerian Moorish life in passing seems to be most beautiful.
>
> Ruin has well been called "the charm beyond perfection." It is the freeing of the spirit. And that moment while the spirit lingers is most exquisite of all. It is that period in Algeria now. The French conquest, while destroying and covering much, has caused the Oriental life to reveal its most spiritual loveliness.

The book is permeated with sympathetic interest and imagination. It was well worth writing. Some of its half-tone illustrations are especially charming and characteristic.

Handbook of Polar Discoveries. By A. W. Greely, Major-General U. S. Army. (Third Edition, Revised and Enlarged.) iv and and 325 pp., Portrait, 12 Maps, and Index. Little, Brown & Co., Boston, 1906. (Price, $1.50.)

General Greely's handbook has grown from 257 pp. in the first edition, ten years ago, to 325 pp. It is now a polar instead of merely an Arctic manual, for it summarizes Antarctic discovery from the earliest days to Charcot's expedition of 1903. The important work of the past decade in the Arctic domain has also added a considerable number of pages. No handbooks on exploration are likely to be so useful in the coming years as those relating to the polar regions, for these zones now offer the largest opportunities for pioneer research ; and this manual, covering the whole field of polar work, and written with authority, is very conveniently arranged for reference. It gives the larger facts relating to the whole field of polar endeavour, and the copious bibliographies closing the chapters and at the end of the book refer the student desiring more details to a large number of literary authorities. The book compresses the vital features of 7,000 pages of original narrative; and though it is very condensed, it gives a good and clear idea of what has been accomplished in this department of geographical discovery.

Statistique Annuelle de Géographie Comparée, 1906. By Jean Ribot. 30 pp. Hachette & Co., Paris, 1906.

This is a very compact and well-arranged collection of the latest statistics relating (1) to the population of countries and cities, with figures of their growth, emigration, etc.; (2) food stuffs showing their production, consumption, exportation, and importation in each country; (3) production of textiles, in each country, with their value, exportation, importation, and manufactures; (4) similar information for coal, lignite, iron, copper, and other metals. These statistics are arranged in tables covering the world, and followed by more detailed tables relating to France. The remainder of the pamphlet gives maritime statistics of all the leading ports; figures relating to interior navigation, railroads, the commercial movement by countries, and values of the commodities in trade; and the pamphlet concludes with tables showing the military and naval strength and financial condition of all the leading countries. Few compilations of this sort are planned in a way to give so much information in little space as this small book.

OBITUARY.

S. NICHOLSON KANE.

Mr. Kane had been failing in health for more than a year when the end came on the 15th of November, 1906. The Council of the Society, at a meeting held on the 20th of December, adopted the following Memorial Resolutions:

Resolved, That by the death of Mr. S. Nicholson Kane the American Geographical Society has lost a loyal friend and a valued Councillor.

He became a Fellow of the Society in 1879 and a member of the Council in 1896.

He took an intelligent interest in the affairs of the Society, and always performed with alacrity, zeal, and scrupulous care all duties which were confided to him. By his cheerfulness and unfailing courtesy he endeared himself to all with whom he came in contact.

Resolved, That a copy of the above resolution be transmitted to the family of Mr. Kane, with assurance of the sympathy of the Council.

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